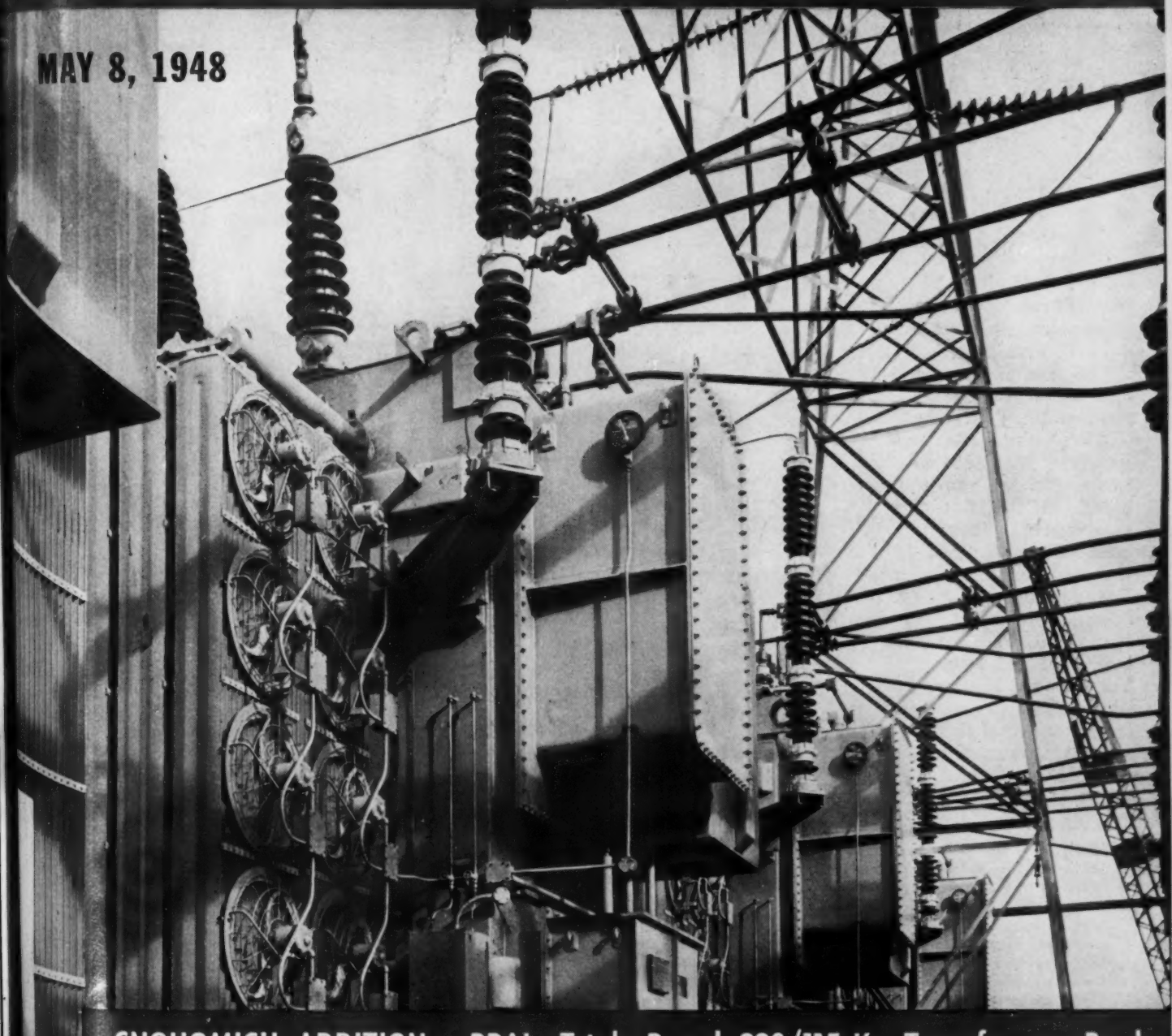
ELECTRICAL WORLD

A McGRAW-HILL PUBLICATION

MAY 8, 1948



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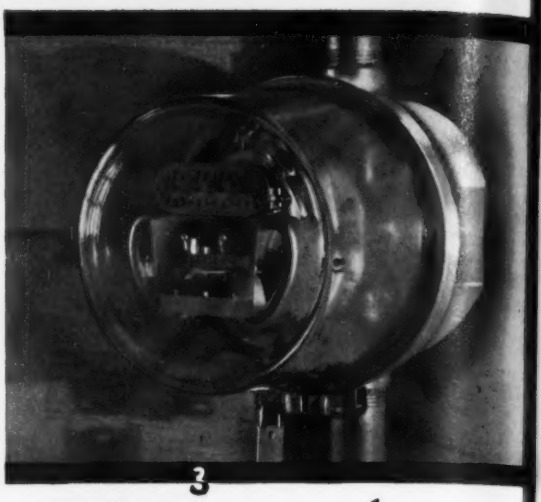
NOW— ALUMINUM METER SOCKETS

Murray



Murray Modern Methods have developed a deep drawn socket meter case, made of 3-S-O Aluminum. The one-piece ring and bar is also deep drawn, made of 52-S Aluminum.

The one-piece case, with the turned-out lip, assures stiffness and a rain-tight job.

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SEND FOR BULLET

503

SPECIAL FEATURES

1. Plenty of hand room.
2. Solderless terminals take up to No. 1 wire.
3. Steel spider plate, aluminum-riveted to back of case, holds porcelain and jaws in perfect alignment.
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5. Ring and bar easily removable by backing out two screws.
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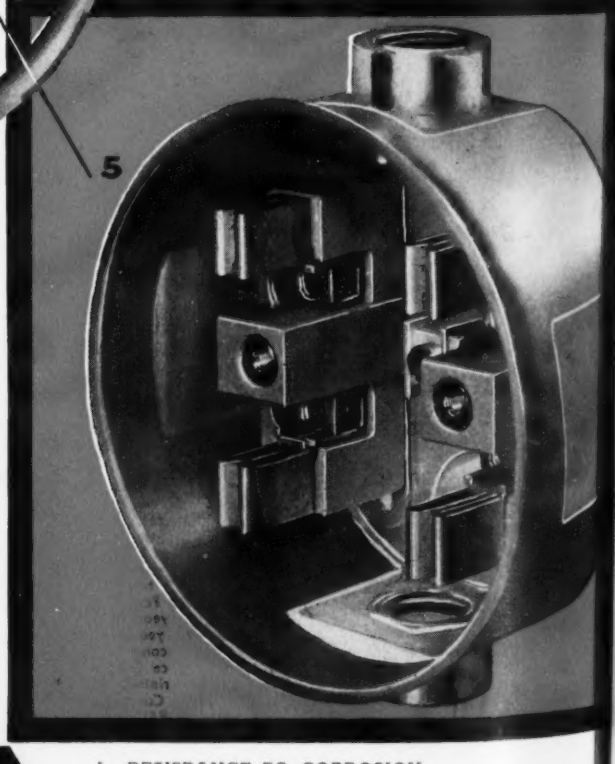
   Equipped with a hub at top and bottom and one in the right side (three way).
2. Cases without knockout in the back.
   Equipped with a hub at top and bottom.
   Equipped with a hub at top and bottom and one in the right side (three way).



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ELECTRICAL WORLD

Published 74 years for those engaged in the business of generating, transmitting, distributing or applying electric power

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Largest-rated single-phase transformers ever shipped to the Pacific Coast, this trio makes up the first 230/115 kv bank at the Snohomish substation of the Bonneville Power Administration near Everett, Washington. Each unit weighs 95 tons

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COMING IN THE MAY 22 ISSUE

Special Report on Load Research And Load Building

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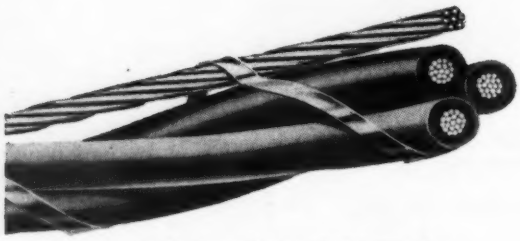

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ALUMINUM CONDUCTORS

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ELECTRICAL WORLD — Editorials

MAY 8, 1948

What's the Fighting About?

POLITICS vs The Public Interest is being fought out in Washington today on the Lilienthal re-appointment to the Atomic Energy Commission. And it isn't peanut politics, either. These GOP senators who oppose Lilienthal aren't looking just for a fat political appointment. They think Lilienthal is an enemy of the American way of life they cherish. No question about it. While he was chairman of TVA, he was, at least insofar as electric power was concerned. He believed in public ownership of power and fought for it. To a distressing extent, he got it. We thought the philosophy was wrong then and we think it wrong now.

The re-appointment of Lilienthal to a five-year term as chairman is full of angles. Lilienthal is the one commissioner for whom the GOP Senate is gunning. So Mr Truman used some galling political horsesense and gave him the most secure spot in a staggered list of re-appointments. This trapped the senators in a political hotbox. It sent them, hat in hand, to a political opponent, seeking a deal which the President at that point, couldn't have made if he'd wanted to. (How could he have rescinded the five-year and substituted a one-year term—and still kept any commissioner on the job?) That having failed, the anti-Lilienthal group now talks of "compromising the compromise" by switching the chairman to a two-year term. This is ridiculous for the same reason the one-year proposition was. It's dangerous, too.

If any real fault may be attributed to AEC after having watched it in action for a year and a half, it is over-caution, occasional timidity. But the nature of AEC's assignment was such that it's hard to tell whether you could blame any humans for being cautious in such circumstances. And who's to say that one of the reasons for over-cautious actions was NOT the August, 1947, expiration date of the commissioners' term? Let the Senator who has not ducked a political issue to gain re-election cast the first opposing vote.

Now if over-caution HAS been a fault of AEC, can it be remedied by another series of one-year terms? Will the maximum of atomic development and preparedness be had from a board awaiting a death sentence—for itself or for its leader? Who wants another year of timidity in the atomic arms business? We know Henry Wallace does. Who else?

Actually, as we read the law, the whole episode is beside the point. Under the normal course of events, one appointment will be vacant in August, 1949. If there is a Republican president next year, the appointment will be his. Another section of the law says the President shall designate a member as chairman. If the next President does not consider Lilienthal the right chairman, then he can name his own appointee to the chairmanship. Coldblooded, perhaps. But it's the law.

ELECTRICAL WORLD supported Lilienthal a year ago. Today the issue isn't Lilienthal at all. The issue is whether AEC shall have the chance to lead a normal life or whether it shall continue on "political per diem." However one regards Lilienthal, what hangs in the balance is the maximum development of atomic energy, for whatever uses. Whoever thinks this can be had from such "compromises" as have been suggested is sanguine indeed. What a time to be sanguine.

Who Is The Victim?

ON APRIL 26, *The New York Times* reported that City Councilman Michael J. Quill, who also is president of the CIO Transport Workers Union, had warned that five private bus lines in New York would be struck unless wage demands were met. *The Times* added:

"Mr Quill confirmed reports that the union's strategy would be to concentrate its wage pressure on the private lines before precipitating a showdown with the (municipal) Board of Transportation (which operates subways) . . . The union's strategy is based on the greater freedom from legal restraint it enjoys on the private lines . . . Strikes on the municipally operated lines would make the participants subject to dismissal . . . No such limitation exists in the private companies."

When anyone considers discrimination between utility operations, let him not stop with the power business. Let him consider also New York City's transit industry, and the discrimination between its components.

It keeps popping up everywhere, this discrimination between comparable operating utilities. Nationally and locally, it is a matter of law—pretty senseless law, too.

There are few jurisdictions in the United States—where such utility services as gas, electricity and local transportation are rendered privately—in which some regulation of rates is not publicly imposed. What's the point of all this public regulation? Why, protection of the public—on rates, on service, on continuity, on investment.

With all this public effort for public protection, why the discrimination between comparable utility operations? New York passed a bill subjecting striking municipal transit employees to dismissal. What makes New York City's bus transport any less vital? Why undo the public protection work of the New York State Public Service Commission? This is one effect of a law which implies plainly that a strike on the private bus lines is of small account, unlike a strike on public subway lines?

Electric power is almost completely regulated. Yet in law after law, Congress has said that if the public owns its own power facilities, it may escape financial burdens which may not be avoided by those served privately.

Who's protecting what part of which public, one might ask? It's all the same public. But you'd never know it to judge by some of the "Class B Citizen" tickets that large portions of the public are handed on utility regulation. Most of us pay an average of 3.10 mills per kilowatt-hour tax on our electrical energy. Some of us don't. And who gets hurt by any such inconsistency? That "nasty old power trust?" Not at all, it's the public. Utilities, however, owned, exist only to serve the public, have no meaning other than in public service. How could you help but hurt the public if you discriminate between utilities?

The absurd answer to discrimination is quick and easy: —make all utilities publicly owned enterprises. That would level out the discrimination, quickly and effectively. But does any serious person want to argue that the United States would buy that answer today? Congress wouldn't have it. Hardly a state, if any, would have it. By no means all municipalities would have it. Locally, the trend has been in the opposite direction for years.

There's another answer, neither quick nor easy. It is for all legislative bodies, from the township to the Congress, to review their utility laws and remove the discriminations. That, we think, would be along the line of good government. It would not relieve the "power trust," or the "gas trust," or the "transit trust." It would relieve, on the contrary, the citizen served by these industries. It would relieve the man who voted for utility regulation because he wanted non-discriminatory utility service.

Let Him Carry the Ball

DO POWER company managements fully use their advertising talents to sell their companies and their service? P.U.A.A. members would insist they do not.

Why such an answer? Because the typical power company advertising manager feels he is a stepchild. This springs largely from management. It has small knowledge of or faith in the possibilities of its advertising people. Such a blind spot isn't unnatural. Power company management normally is of technical, legal or financial background.

But perhaps some of the blame rests with the ad managers themselves. Theirs is a selling job, isn't it? Why have they not sold themselves—to management?

Wherever the blame lies, the necessity for a change is plain. In the coming battle for sales, neither party can afford to slight the other. The responsibility for correcting the situation is dual. One rests on management, which must give the ad man his chance. The other rests on the ad man, who must sell the job he can do.

Great Day Comin'

IN FOOTBALL PARLANCE, today's box score on "anti-utility-strike" legislation is "one down, about nine to go." All of a sudden, recently, Wisconsin's 1947 law, aimed at protecting the public against strike-born interruption of utility service, ran into an abrupt legal defeat. Doubtless, other of the 1947 state laws attempting the same thing will also be tested.

But the next big test is being readied today in Washington. John Lewis is going to the U. S. Supreme Court with an appeal from his most recent contempt conviction. At issue this time will be that section of the Taft-Hartley Act which provided the legal grounds for Lewis' latest conviction. And it may well provide the first final test of a major section of the Taft-Hartley Act.

This will be an important decision for the utility business. In a very real sense, it will be one of the utility industry's cheapest trips to the Supreme Court. But first and foremost, it will give the public service industry a close look at the legal effectiveness of the federal formula for preventing public utility strikes. As such, it will give the industry some idea of whether the great legislative revolution of 1947 achieved one of its purposes, or whether the job remains to be tried over again.

NEWS OF THE ELECTRICAL WORLD

The Electrical Week

Washington commands the news again this week, and it does so with the first assertion that TVA will not get any money for New Johnsonville this year. The possibility that it will get the plant later is not foreclosed, though, and settlement of the issue for this year was not based on principles of power ownership . . . Elsewhere in Washington, two attempts are being made to prevent a new wave of pay suits similar to the "portal-to-portal" wave of two years ago . . . In California, the U. S. Department of Justice has complained to the state commission against PG&E . . . The Pennsylvania Electric Association's equipment group is studying control room lighting . . . And the Atomic Energy Commission has contractor-trouble.

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There's rumor going 'round that the Atomic Energy Commission will build an atomic factory close to TVA's proposed New Johnsonville steam plant.

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Gov. Thomas E. Dewey followed an old political principle last week. With Taft and Stassen monopolizing the front pages with their primary struggle in Ohio, Dewey fell back on the perennial St. Lawrence project as a vehicle to ride onto Page 1.

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The General Electric Co is "back to normal" on 75% of its apparatus business.

• • •

South Carolina Public Service Authority, which operates Santee-Cooper, is behind efforts to set up an REA-financed transmission co-op. The proposed co-op would build lines to carry Santee-Cooper power to every REA distribution co-op in the state. The Authority reportedly wanted to guarantee the new co-op's loan, but REA said no. It may make the loan, however, if enough co-ops will join.

• • •

One Midwest utility is currently selling 10% of the manufactured output of germicidal lamps. It has developed a unit for home use and is pushing it also in schools and commercial establishments.

Extent of the "left-right" political split in the CIO is indicated by the Illinois situation. Grant Oakes, president of the Farm Equipment Workers, CIO, is the Wallace candidate for governor. CIO-PAC is against him.

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That German air circuit breaker which Bonneville tested some time ago is now permanently installed at Spokane for observation under operating conditions.

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Some underwriters have warned that Wisconsin's 3% dividend privilege tax could make it hard to peddle securities liable under it in a highly competitive market. They're particularly concerned about the difficulties if the tax were to be raised—as most taxes eventually are.

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Charles E. Wilson says GE is anticipating the operation of a pile of atomic power plant and, later, operation of a full scale power plant at Schenectady.

• • •

Awareness of the function of and need for electric power is spreading in Washington. One capital information service recently referred to the need for more power four times in two pages.

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N. T. Veach, Kansas City consultant, told a Missouri utilities group that construction costs have increased more because of union labor's featherbedding and lowered productivity than because of wage boosts.

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Some members of Congress are concerned over two aspects of the struggle over TVA's proposed New Johnsonville steam plant. One is the report that President Truman told Chairman Clapp some time ago to forget about Congress and get on with the job. The other is the question of just what work, if any, TVA already has done at the plant site.

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Stockholders are writing all sorts of notes on proxies they are returning to utilities these days. One, from a minister, urged that all stockholders meetings open with a prayer. The writer offered to come about 1,000 miles to ask the blessing, if necessary.

TVA Won't Get New Johnsonville Plant, Survey of Congress Shows

CONGRESS WILL TURN thumbs down on the Tennessee Valley Authority's proposal to build a $54,000,000 steam generating plant at New Johnsonville, Tenn.

TVA will not get a flat "no" on the project, however. Congressional action will take the form of refusal to approve an item of $4,000,000 in the agency's annual budget to start construction of the plant. TVA will be advised—perhaps invited—to discuss the proposal with Congressional groups later. But possibility of starting construction of the plant this year definitely will be foreclosed.

No Steam Plant This Year

Final outcome of the steam plant fight was made clear this week in a check of members of Congress by ELECTRICAL WORLD's Washington staff. It was learned that both opponents and proponents of the project now believe that it is "dead"—at least for the 1948 calendar year.

It also seemed obvious that the issue would not be resolved either on the merits of the proposal or on the basis of sympathy for private vs public development of electric power. It looked more like a victory for the increasing sentiment in Congress to halt expansion of government operations in business fields generally.

President Truman endorsed the New Johnsonville project last January by requesting the $4,000,000 start-work fund in his annual budget. The budget item went to Congress as part of the government corporations appropriation bill for 1949, along with TVA's annual money requirements.

Bill to Go to House

The bill still was under consideration by the House Appropriations Committee at midweek. TVA Chairman Gordon Clapp finished extensive testimony before the Committee last week, and it was expected that the entire bill would be ready for House floor action in the near future. There the fight for the plant is likely to be renewed, as well as later in the Senate.

TVA would locate the plant near its Kentucky Dam. Plans called for initial installation of a single generating unit of 125,000-kw capacity. Agency spokesmen estimated that this machine could be put on the line in 1951 if work on the plant was started this year. Two other units of similar capacity would be installed later, they advised.

The proposal touched off a storm of controversy, in the Congress, and in other forums. TVA's justification of the plant, in brief, was that it is required to meet foreseeable increases in its system load which could not be carried by its existing hydro plants and those now under construction.

This stand was vigorously supported before members of the House Committee by the TVA staff and representatives of the Tennessee Valley Public Power Association. Spokesmen of the privately financed electric utility industry argued that the agency had no legislative authority to undertake steam plant construction.

But the Congressional opposition to the proposal centered around the "no-more-government-in-business" group, with little evidence of either sympathy or understanding for the technical arguments involved.

•

Berlin to Get Plant

Construction has started on the largest power plant in Germany. The plant, known as the Berlin West Plant, will be built in the British sector of Berlin. The Russians, who stripped the plant of all equipment when they captured it in 1945, opposed its reconstruction. They now control the entire power supply of the city. The plant will have a capacity of 110,000 kw. Two German firms are building equipment.

Michigan Co-op Gets REA Loan to Build Gas Lines

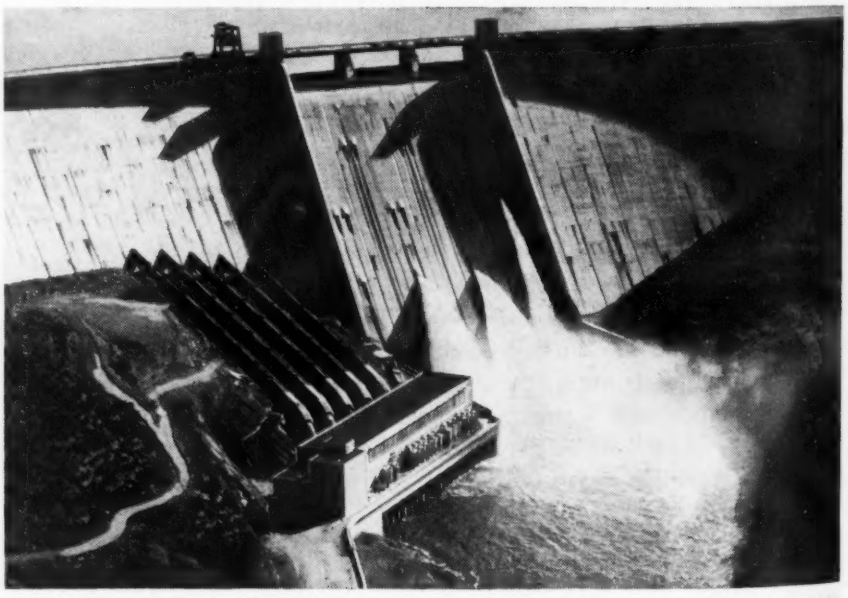
The Rural Electrification Administration has agreed to finance a natural gas fuel supply for the generating plants of one of its borrowers.

O&A Electric Cooperative, Newaygo, Mich, has obtained a REA loan for the output of a gas field near its Hersey generating plant, together with funds for new generating units and other expansion projects. Of the total loan of $698,000, the co-op expects to spend approximately $85,000 for gas lease rights. In addition, it will pay a royalty of about 8 cents per MCF.

O&A justified its request for this portion of the loan as providing the "most reasonable fuel" available for its two small generating plants. These plants now have diesel generating units with a combined capacity of 2,380 kw. New dual-fuel (gas and oil) diesel units of 400 kw and 1,100 kw, respectively, will be added at plants at Burnips and Hersey.

The co-op will take the full output of the gas field, which has proved reserves of something over 1,500,000,000 cu ft, it was reported. About 10 miles of 4-in. pipe lines will be laid from the field to the power plants. Estimated cost of the pipe will average around $6,000 per mile.

O&A is one of seven Michigan co-ops which are forming the new Wolverine Power Co-op, a proposed generating and transmission co-op. It is expected, co-op sources said, that Wolverine eventually will take over the generating operations of all its members.



TO INSURE FLOOD PROTECTION, the Bureau of Reclamation is by-passing water at its Shasta Dam in Northern California. The bypassing started Apr 16. In seven days 94,000 acre ft of water were spilled. This water would have generated 38,000,000 kwhr of energy. During March, water was so low that one 75,000-kw generator was idle

'Overtime on Overtime' New Threat to Industrial Equilibrium of Nation

INDUSTRIAL GROUPS this week were becoming aware of—and excited about—a sequel to the "portal-to-portal" suits which boomed—then bust—two years ago.

"Overtime-on-overtime" is the catchphrase description of this threat to industrial equilibrium. It is based on two U. S. Circuit Court rulings which upheld the "overtime-on-overtime" concept. It arises from an unspecific phrase in the Fair Labor Standards Act.

Already, an appeal from the "overtime-on-overtime" concept is before the U. S. Supreme Court. And a bill is before Congress which would squelch the whole thing.

Here's what "overtime-on-overtime" is all about:

The 1938 Wage-Hour (Fair Labor Standards) Act requires covered employers to pay one and one-half times the "regular rate" of pay for work beyond 40 in one week. Now two Circuit Courts have ruled that where "time and a half" overtime pay is part of a labor contract, it must be considered as part of the "regular rate" in figuring time and one half for actual overtime.

As an example, suppose a contract stipulates that work on any of a number of specified holidays must be paid for at time and a half. Then with, say, July 4 falling midweek, a man who earned $1 per hour and who worked on July 4 as well as the other four working days of that week would have a wage bill as follows:

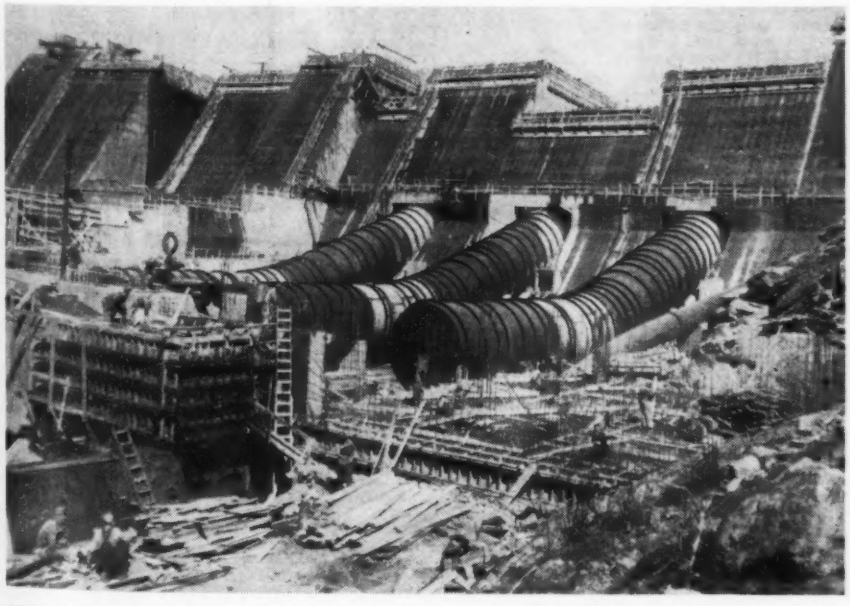
Monday, $8; Tuesday, $8; Wednesday (July 4) $12; Thursday, $8; Friday, $8. Total, $44. Under the "overtime on overtime" concept, if he worked the sixth day that week, the "regular rate" rate for that day would be the $44 he earned divided by the 40 hours he worked, or $1.10 per hour rather than $1 per hour. Time and a half of that "regular rate," then would be $1.65, rather than $1.50.

And the employer would have to pay the $1.65 even though the employee had worked only four days that week at straight time.

Obviously, where no contract exists, the problem would not arise, except in cases where premium pay has become so routine as to be easily construed by the Wage-Hour Administration as part of a "regular rate" of pay. But the problem would arise wherever a contract specifies premium pay.

Introduced by Sen Joseph Ball, Minnesota Republican, is a bill which would define the phrase "regular rate" of pay so as to avoid pyramiding of overtime pay. This would be done by dividing hours-worked each week into normal straight-time compensation. And it specifies what must be included and what must be excluded from "normal straight-time compensation."

But it's problematical whether any changes in the Wage-Hour Act will be made this year. And even if they were, they can not cancel accrued liability, assuming the Supreme Court upholds the Circuit Court rulings. But the two-year statute of limitations which was written into the Portal-to-Portal Act of 1947 would govern any attempt to chase "overtime-on-overtime" payments all the way back to 1938.



ALLATOONA PROJECT of the Army Engineers has progressed to a point where workmen, in foreground, have the foundations for the powerhouse underway. The dam is across the Etowah River. Two 36,000-kw and a 2,000 kw unit will be installed

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Wimberly Stays on FPC; Buchanan Hearings Open

Status quo of the Federal Power Commission membership was assured for possibly another year by action of the Senate this week.

The Senate moved swiftly to confirm the reappointment of Commissioner Harrington Wimberly, whose present term expires next June 22. Committee hearings opened May 6 on the appointment of Thomas C. Buchanan of Pennsylvania to fill a year-old vacancy on FPC.

A Senate committee last week decided to speed the Wimberly nomination without hearings, a customary procedure in the case of non-controversial reappointments. The Oklahoman's new term will expire in June, 1953. He is a Democrat.

Buchanan, also a Democrat, was named for the term expiring June, 1952. His confirmation would put three Democrats on FPC, including Commissioner Leland Olds, whose term ends June, 1949. But major divisions of the Commission, especially on natural gas matters, have found Chairman Smith an avowed independent, and Wimberly opposing Olds and Republican Commissioner Draper. Buchanan is reportedly an ardent advocate of Commissioner Leland Olds' regulatory theories.

Senate leaders were reluctant to comment on the Buchanan nomination prior to the committee hearings. But there were persistent reports that the appointment might be held up, probably for political considerations. By delaying action on this vacancy until next year, Republicans could assure themselves control of FPC in 1949 if the GOP wins the Presidency in November.

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Danville to Build Plant

Danville, Va., is studying bids for construction of its Brantly steam station on the Don River. The plant is to have a capacity of 7,500 kva in a single unit. Pulverized coal will be used for fuel.

AEC Employee Relations Policy Gets It in Trouble with Contractors

THE ATOMIC ENERGY COMMISSION put its foot in it last month. And what it put its foot in was one of the touchiest issues between AEC and its contractors —employee relations policy.

The subject was standards of employment for scientific workers hired by the contractors who operate AEC laboratories and production plants. AEC has been worrying about this. A year ago, it appointed a committee, headed by Dr F. Wheeler Loomis of the University of Illinois to study the subject.

It Was Supposedly a Secret

Based on the Loomis committee report, AEC last March drafted a set of pay and working condition standards for scientists. This was intended to go —in utmost confidence—to AEC area managers. It told them just how far they could go in negotiating with contractors over the costs, in the way of salaries, vacations, and such that would be allowed on cost-plus contracts.

But somebody slipped. The bulletin —GM-72—was reproduced and circulated to the whole AEC mailing list.

Immediately, the contractors were up in arms. It looked to them as if this were a move to take employee relations out of their hands, to reduce them to the status of hired managers rather than independent contractors. All of them have been pulling all the propaganda stops to convince their atom employees that they were contractor people—Carbide employees, GE employees, University of Chicago employees, or whatever —not government workers. And here was AEC establishing standard conditions of employment for the whole atom program, cutting right across contractor policies.

Contractors Were On the Spot

Any contractor who wasn't meeting the standards of GM-72 either had to adjust his entire personnel policies, atomic and non-atomic; set up his atom employees as an especially favored group; or appear maliciously to be withholding from his atom people benefits that AEC was perfectly willing to pay for.

AEC blushed furiously for a month and then withdrew the order. But it's an open secret that the terms of GM-72 still represent AEC policy. And the whole episode reflected one of the basic dilemmas that AEC faces.

On the one hand, the Commission is carrying out its job through private contractors. It is trying, with considerable sincerity, to build up a maximum of industrial participation in its work in preparation for the time when atomic energy will be available for industrial exploitation.

On the other hand, atomic energy is a little sector of managed economy. This means more than allocating fissionable material. AEC is faced with a shortage of scientific talent. It has to see that there's no personnel raiding by contractors, no shopping around by scientists—and at the same time, see that scientific skill is free to shift to where it's needed most.

Similarly, labor conditions in the atom plants are supposed to be worked out by contractors and their workers. But at every table where unions bargain on wages or scientists dicker politely over salaries, AEC is present in spirit. It has to OK the costs.

The detailed terms of GM-72 have a wider significance than the atom program. AEC is one of the largest buyers of scientific talent in the country. The standards it approves are going to have their effect on every company which employs technical people.

Here are the working conditions, AEC thinks scientists should have:

A month's vacation with pay. Additional vacations for those exposed to unusual radiation hazards. Freedom from time-clock punching. A system of retirement annuities with equity vested in the employee to facilitate transfers. Payment of travel expenses to scientific meetings. Payment for movement of families and household goods for permanent employees. Sick leave conforming to university practice. Opportunity for basic research, with some leading scientists in each laboratory freed from all "programatic" work.

Staff Divided Into Groups

As to salaries, AEC would divide scientific staff people into three groups:

Junior scientists—men with a bachelor's degree doing research under supervision. Salaries would range from $250 to $400 per month. Starting salaries would ordinarily be: for bachelors, $250 plus $20 for each year of experience; for masters, $270-290 plus $25 for each-year.

Associate scientists—men with a doctorate capable of doing assigned work independently. Salaries would run from $350 to $700 per month, would normally start at $350-$400 plus $30 for each year of experience.

Senior scientists—experienced men capable of formulating and carrying out broad programs of research. Pay should run from $550 up, but salaries over $1,000 per month must be approved by AEC.

Changes in Capacity Reported to Federal Power Commission

PLANT ADDITIONS DURING FEBRUARY

Utility	Plant	Fuel	Capacity (Kw)
Citizens Utilities Co	Newport, Vt	IC	920
Luzerne County Gas & Electric Corp	Hunlock Creek, Pa	S	20,000
Red Bud Power, Light & Water Dept	Red Bud, Ill	IC	556
Lake Superior District Power Co	Athens, Wis	IC	1,000
Wisconsin Hydro Electric Co	Clear Lake	IC	1,000
General Minnesota Utilities Co	Remer	IC	85
State Center Light & Power Dept	State Center, Iowa	IC	300
Strawberry Point Light & Water Dept	Strawberry Point, Iowa	IC	372
Neola Light & Water Dept	Neola, Iowa	IC	200
Kansas City Power & Light Co	Grand Avenue	S	35,000
Otter Tail Power Co	Oakes, N. D.	IC	1,000
Otter Tail Power Co	Parshall, N. D.	IC	400
Otter Tail Power Co	Lake Preston, Minn	IC	1,000
Osage City Municipal Light Dept	Osage City, Kan	IC	690
Seaford Light & Power Dept	Seaford, Del	IC	846
Potomac Edison Co. (Md.)	R. P. Smith	S	5,000
Florida Power Corp	George E. Turner	S	25,000
TVA (January)	Kentucky Dam	H	32,000
Texas Electric Service Co	Odessa	IC	540
Corps of Engineers	Fort Peck	H	15,000
Montana-Dakota Utilities Co	Sheridan, Mont	S	3,000
Commonwealth Utilities Corp	Akron, Colo	IC	300
Bureau of Reclamation	Grand Coulee	H	108,000
Southern California Edison Co	Redondo Beach	S	66,000

PLANT RETIREMENTS DURING FEBRUARY

Iowa Public Service Co	Correctionville	IC	240
Missouri Edison Co	Louisiana	IC	40
Missouri Edison Co	Elsberry	IC	118
Otter Tail Power Co	Jamestown, N. D.	IC	400
Otter Tail Power Co	Jamestown, N. D.	S	468
Northern Electric Co-op, Inc	Opheim, Mont	IC	189
Mora Public Service Co	Cleveland, N. M	IC	150

H—Hydro, IC—Internal Combustion, S—Steam.
United States capacity as of March 1—Steam, 36,302,218 kw; Hydro, 15,125,597 kw; Internal Combustion, 1,356,588 kw; Total, 52,784,403 kw.

AIEE OFFICERS at Northeastern District meeting, left to right, C. D. Hewitt, chairman of Connecticut Section; Victor Siegfried, district secretary; Blake D. Hull, national president; Ernest W. Davis, national vice-president; and J. F. Walker, meeting chairman

U.S. Acts to Force PG&E to Serve Federal Agencies at Exchange Rate

THE JUSTICE DEPARTMENT announced this week that it had filed with the California Public Utilities Commission a complaint against the Pacific Gas & Electric Co. The complaint demands that the company supply energy to federal agencies on an exchange basis for power which it receives from federal generating plants.

The action points out that PG&E purchases and transmits energy from the Shasta Dam, Mare Island, and Yosemite Plants, all operated by federal agencies. Only with the Bureau of Reclamation, which operates the Shasta plant, has the company made an exchange agreement, the complaint states, although it has such arrangements with various other electric companies.

Government agencies purchasing power from the company, including the Navy, Army, and Air Force, have been unable to obtain an exchange rate, it is charged. The result, the complaint adds, is "unjust, unreasonable, inefficient, and inadequate service" to the government, in violation of the California Public Utilities Act.

The complaint asks the Public Utilities Commission to fix a "just and reasonable rate" to be paid the company for exchange service with federal agencies, and for reparations to government for "past losses" due to failure of the company to provide such service.

PG&E buys energy from the Bureau of Reclamation, the Department of the Navy (at Mare Island) and the National Park Service (at Yosemite). Through its distribution system it supplies a number of military establishments and federal research laboratories. It is for these that the Justice Department is asking reduced rates on an exchange or "wheeling" basis.

Justice Department spokesmen said that the proceeding against the company was initiated at the request of Interior Secretary Krug; the Departments of the Army, Navy, and Air Force; and the National Advisory Committee for Aeronautics. These sources declared that the company not only has refused "wheeling" service to federal agencies but "at times has curtailed deliveries to military establishments and vital government research laboratories, thus rendering the company's service . . . inadequate, insufficient, and unreliable, not only for ordinary needs but for the requirements for national defense."

"In effect," Assistant Attorney-General John Sonnett commented, "the government buys back its own power at rates far in excess of those the company pays it for same power. These excess amounts are also in excess of a reasonable fee for the transmission service."

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City Must Issue Bonds

Power to issue revenue bonds for improvement of municipal utilities rests with the city and not with its board of public utilities. This was the ruling recently of the Arkansas Supreme Court. The case, a friendly test suit, involved the Lepanto City Council and Utility Board. Lower courts had ruled against the city. Improvements to the municipal water system were involved.

Varied Topics Discussed at AIEE Northeast Meet

Electrical engineers in many fields were catered to last week as the American Institute of Electrical Engineers held its Northeastern District meeting at New Haven. Attendance exceeded 800.

President Blake D. Hull reported that higher costs are giving AIEE budget problems but that economical administration is a major objective. He said that a national association of all engineers is needed. The growing influence of Washington in engineering activities makes the appointment of a residential official desirable, he added.

An innovation at the meeting was a session devoted to textile machinery drives. Notable advances have been made in multi-motor drives and controls for slashers in cotton, worsted, and rayon mills. Slasher drives are being converted from an all-mechanical to an all-electric basis. With proper handling, many production advantages follow.

S. W. Zimmerman, Cornell University, made a strong plea for high-voltage laboratory work in university instruction and research. Excellent work had been started at Cornell, he said, before the recent fire destroyed the laboratory.

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Buggs Island Contract Let

A $13,363,275 contract for the construction of the Buggs Island Dam and powerhouse substructure has been awarded by the Army Engineers to a group of contractors. The dam will span the Roanoke River between Mecklenburg County, Va., and Vance County, N. C.

ELECTRICAL EQUIPMENT COMMITTEE of the Pennsylvania Electric Association at their recent meeting at Hershey

Lighting of Power Station Control Rooms Studied at PEA Symposium

LIGHTING OF POWER station control rooms and switchboards came in for critical examination by instrument makers, utility engineers, and manufacturers' lighting specialists at a symposium during last week's meeting of the Pennsylvania Electric Association's Electrical Equipment Committee at Hershey.

While discussers agreed that glare-free lighting of instrument dials and the elimination of conflicting shadows were prime lighting objectives, no single solution was offered that met all objections. Use of glare-reducing glass for instrument covers, internally-illuminated dials, and inclined, open-top instrument covers were mentioned as ways of improving visibility. Also mentioned was the use of both direct and indirect lighting to obtain luminous ceilings of low brightness contrast. Elimination of windows from station control rooms was strongly recommended as a corrective measure against glare.

D. W. Taylor reported that inclined "open-top" instruments and tilted instrument panels will be used in the control room at Public Service Electric and Gas Co's new Sewaren (N. J.) Station. Here control panels will be lighted to 45 or 50 ft-c with a combination of direct and indirect lighting from shielded fluorescent tubes in coves around a parcyl-type ceiling.

Use of an all-over louvered ceiling lighted from above with three-lamp fluorescent fixtures will be used at Pennsylvania Power & Light Co's new Sunbury Station, according to Walter Morton. He reported that lighting studies showed a solid-ceiling light source to be best for control rooms. Control lenses are also suitable if supplementary lighting is used to soften contrast. Existing control rooms can be effectively relighted with indirect trough-type units and old dark control boards improved by coating with opalescent aluminum lacquer. Black instrument letters against white dials are more visible than white on black, he said, but noted that internal lighting of instrument dials was undesirable. Windows in controls rooms should be avoided.

B. R. Nevins disclosed that Philadelphia Electric Co's new Barbadoes Station control room will be designed with an all-over translucent plastic ceiling lighted from above with cold cathode tubing. Canopy lighting will be used on turbine and boiler gage boards.

Low-intensity light sources in combination with non-glare glass for instrument covers are an almost perfect answer to control room lighting problems in the opinion of C. M. Skooglund, West Penn Power Co. Such low brightness can be obtained with louvered ceilings, but provisions should be made for relamping from above in such cases, he said.

J. Q. Wray, Pennsylvania Water & Power Co, reported successful relighting of an existing control room at Holt-

SWITCHBOARD LIGHTING symposium at PEA Electrical Equipment Committee meeting drew on the experiences of Carl M. Skooglund, left, West Penn Power Co; Walter M. Morton, Pennsylvania Power & Light Co; Donald W. Taylor, Public Service Electric & Gas Co; Benjamin R. Nevins, Philadelphia Electric Co; and J. Q. Wray, Pennsylvania Water & Power Co

wood Station with indirect fluorescent troughs. At Safe Harbor, however, difficulty was experienced in finding fixtures that blended with other station lighting equipment.

C. P. West and W. H. Kahler, Westinghouse Electric Corp, felt that brightness contrast was the chief obstacle to good control room lighting. Areas of high brightness are picked up and reflected in instrument covers as glare, they warned. Uniform low brightness in ceilings will tend to correct the problem, they said.

C. E. Egeler, General Electric Co, saw two promising solutions: (1) controlled direct lighting for control panels, (2) complete indirect lighting for the entire room. These alternatives suggest control lenses with direct lighting or fluorescent lamps properly louvered or shielded, he stated. He suggested that windows be covered or eliminated from control rooms.

The viewpoint of instrument makers was represented by J. M. Hegge, Westinghouse; E. G. Howe, General Electric; Frank Lamb, Weston; and E. S. Maurey, Roller-Smith. They pointed out that instrument makers have attempted consistently to increase the readability of instruments by use of non-glare glass, dropping dials to free the scales of shadows from overhanging cases, and improvement of scale typography.

H. A. P. Langstaff, West Penn Power Co, cautioned against control room lighting arrangements that are difficult to maintain. Lamps should be renewable without bringing ladders into control rooms. Lamps in instruments or switchboards complicate maintenance and make instruments unreadable when they burn out. Louvered ceilings, unless they can be cleaned from above, are a further maintenance problem, he indicated.

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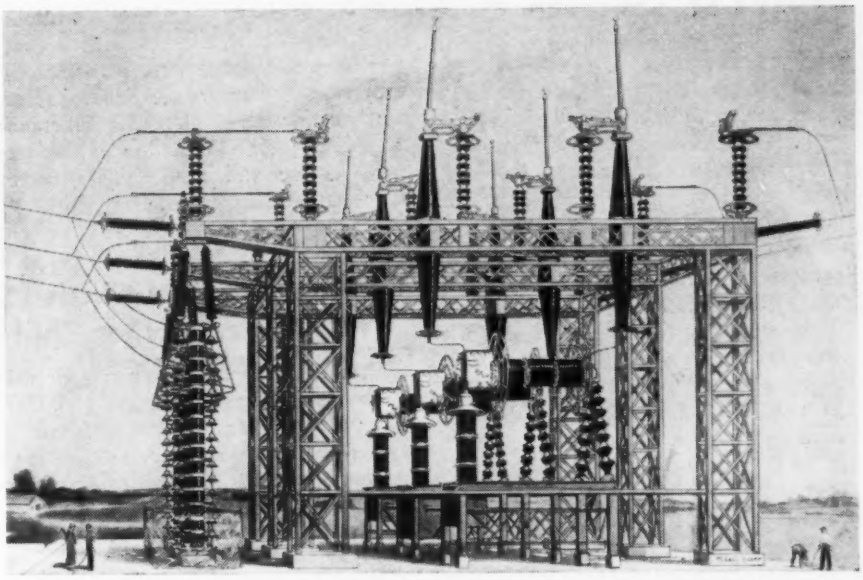
Norman Stoll Appointed BPA General Counsel

Norman A. Stoll, assistant solicitor of the Department of Commerce, has been appointed general counsel for the Bonneville Power Administration. He will succeed Robert R. Willard, who left BPA recently to join the legal staff of the Atomic Energy Commission.

A graduate of the University of Wisconsin, Stoll was an attorney for the Securities and Exchange Commission before entering the army during the recent war. His military service included a two-year assignment with the U. S. War Crimes Commission. He has been employed by the Commerce Department since 1946.



10,000,000 KVA is the interrupting rating of the General Electric Co impulse breakers which are to be installed in 1949 at Grand Coulee. In this artist's drawing, isolating switches are above, and the lightning arrester stacks are at the left

Coulee Breakers to Have 10,000,000-Kva Rating

Virtual tripling of interrupting capacity has been achieved in the six 230-kv circuit breakers ordered by the Bureau of Reclamation for installation at Grand Coulee next year. These General Electrical impulse breakers are to have a 10,000,000 kva rating. The largest rating in any previous installation has been 3,500,000 kva.

Tests of a single pole at Grand Coulee demonstrated ready capability of interrupting the 8,700,000 kva of fault current of which the eight 108,000 kva units at the plant are capable. This magnitude of staged fault generator current was by far the greatest attained up to the time of the field test.

The Grand Coulee-Bonneville system constitutes not only the largest extant aggregation of capacity for such tests but also the largest concentration of power anywhere in the world. The availability of breakers with the 10,000,000-kva interrupting capacity is expected to facilitate the evolution and expansion of the system without the formerly contemplated resort to 3-winding transformers, reactors, and complicated bus interconnections.

The units designed for the Grand Coulee switchyard will be practically identical with the 360-kv breakers designed for the high-voltage corona tests at the Tidd Station of American Gas & Electric Co. The latter, however, were provided with six series breaks. A lesser number will be adequate for the 230-kv duty on the BPA system.

In addition to the greatly increased capability of the new design the installation will, for the first time, it is confidently believed, embrace the breakers, the interlocked isolating switches, and the lightning arresters in a single unified design (see illustration). The current transformers will be incorporated in the bushings of the isolators and will be so connected with the relays as to afford overlapping protection—the breaker itself will be included in both zones.

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President and Congress Deadlocked over AEC

The battle between the President and the Republican-controlled Congress over the make-up of the Atomic Energy Commission still was deadlocked this week. So-called "compromise bills" were introduced in both House and Senate, but they were conceded little chance of success.

Chief bone of contention remained the President's insistence that Chairman David E. Lilienthal be given the longest—five-year—term on AEC in making permanent reappointments of all Commission members. The anti-Lilienthal fight, which rocked the Senate last year, still had not broken into the open, however.

Most highly-regarded "compromise" was that proposed by Sen B. B. Hickenlooper of Iowa and Rep W. S. Cole of N. Y., both Republicans. Instead of installing permanent commissioners for terms of one to five years, as required by present law, the Hickenlooper-Cole bills would amend the Atomic Energy Act to extend the temporary terms until June 30, 1950.

The White House maintained a firm stand against any "compromise."

Dewey's St. Lawrence Plan for Power Only

For the umpteenth time, the St. Lawrence power project was revived last week. The reviver was Thomas E. Dewey, New York governor and willing standard bearer for the Republicans in the coming presidential election.

Under the Dewey plan, the seaway features of the project have been dropped. Nothing is left but a 2,200,000-hp power project which New York State would develop in partnership with the Province of Ontario. Significantly, the plan was announced Apr 30 in Albany by counsel to the governor after he had left to campaign in public-power-minded Oregon.

Dewey Orders Negotiations

Dewey directed the State Power Authority to begin negotiations with the Province of Ontario, through the federal government, for an application to the International Joint Commission for permission to develop the power resources of the river.

Under the Boundary Waters Treaty of 1909 and 1910, the International Commission has power to act on such applications from private individuals, corporations, and governments. No additional legislative authority is necessary to undertake a project.

This procedure would eliminate any approval by Congress where the St. Lawrence project has never been given much support. By dropping the seaway features, Dewey pacifies the railroad and New York shipping interests. Finally, since the power from the project would be sold at bus to the private utilities, the governor may hope to lessen any utility opposition.

Dewey asserted that his move was influenced by the growing need for cheap power in New York and the power shortage this past winter in the Northeast. Another factor was the increasing cost of fuel oil and coal used by utilities throughout the state.

Proposed Site Still the Same

The plant site would be that proposed previously. This is in the International Rapids section, between Ogdensburg and Massena, N. Y. The estimated cost for New York's section would be about $161,000,000. Cost to Ontario would be approximately the same.

Dewey proposes that New York pay its share from the proceeds of a bond issue. The bonds would be refunded from power sales revenues.

In Ontario, it has been reported, that provincial authorities look with favor on the Dewey proposal. Ontario is anxious to secure power from the St. Lawrence as its many other hydro plants are all affected by drought and ice conditions.

In Washington, there was little reaction. Sen George Aiken, principal St. Lawrence backer in the Senate, reluctantly endorsed the plan. His reluctance was due to the elimination of the seaway feature and the regional rather than national aspect of it.

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Truman Appoints Curtis to TVA as Morgan Quits

President Truman announced this week (May 4) the resignation of Harcourt A. Morgan, veteran director of the Tennessee Valley Authority, and appointed as his successor, Harry A. Curtis, dean of the College of Engineering of the University of Missouri.

The 79-year-old Morgan had been a director of TVA since its organization in 1933. During the bitter dispute between Arthur E. Morgan. first chairman of TVA, and David E. Lilienthal, he sided with the latter and became chairman in 1938 when Arthur Morgan resigned. He stepped aside when Lilienthal became chairman and accepted the position of vice-chairman, which he has held subsequently.

Dean Curtis, a native of Colorado, taught chemistry and chemical engineering at the University of Colorado and Northwestern University before beginning a career in private industry with several coal and oil firms. In 1929-30 he headed the Chemical Engineering Department at Yale University. He was chief chemical engineer for TVA from 1933 to 1938.

SEC RULINGS

KANSAS POWER & LIGHT CO, a subsidiary of North American Light & Power Co, has been authorized to borrow $5,000,000 from Bankers Trust Co, New York. Credit is to be extended by the bank until Mar 31, 1949, and the loan is to be evidenced by 2% promissory notes. Proceeds will be used for construction program. (Release No. 8137).

GENERAL PUBLIC UTILITIES CORP, New York holding company, has received permission to borrow not more than $8,000,000 from commercial banks. With the funds, the company will increase its investments in subsidiaries and enable them to pay for construction. (Release No. 8140).

NASSAU & SUFFOLK LIGHTING CO, has been permitted to borrow $500,000 from two commercial banks. Nassau & Suffolk proposes to evidence the loans by 2½% notes maturing on Jan. 26, 1949. Proceeds will be used to retire $500,000 of previous notes. (Release No. 8156).

WISCONSIN HYDRO-ELECTRIC CO has received permission to issue $50,000 of 3% notes and $250,000 of first mortgage bonds, 3½% series, due Mar 1, 1972. The notes would be issued in exchange for and as a postponement of the maturity of two $25,000 notes, held by the Harris Trust and Savings Bank, Chicago, due Apr 1 and Oct 1, 1948. (Release No. 8159).

NEW JERSEY POWER & LIGHT CO, a subsidiary of General Public Utilities Corp, has been authorized to sell for cash $500,000 of 2% six-month promissory notes to commercial banks. Proceeds will be used for construction pending permanent financing. (Release No. 8161).

MEETINGS

Edison Electric Institute—Meter and Service Committee, Lafayette, Ind., May 24-25. J. E. Bixler, chairman, Duncan Electric Manufacturing Co, Lafayette, Ind.

PREVIOUSLY LISTED

Northwest Electric Light & Power Association—Annual Business Meeting, Empress Hotel, Victoria, B. C., May 10; Business Development Section, Empress Hotel, Victoria, B. C., May 10-12; Accounting and Business Practice Section, Davenport Hotel, Spokane, May 17-18; Personnel Section and Safety Conference, Medford Hotel, Medford, Ore., June 9-11.

Engineers Club of Philadelphia—Engineering Progress Show, co-sponsored by junior members and the Franklin Institute at the Institute, May 11-16.

Electrical Manufacturer's Representatives Association of Michigan—Industrial Electrical Exhibit, Convention Hall, 4484 Cass Ave., Detroit, May 12-14.

Pennsylvania Electric Association—Systems Operations Committee, Castleton Hotel, New Castle, May 13-14; Transmission & Distribution Committee, Irem Temple Country Club, Dallas, Pa., May 20-21; Prime Movers Committee, Hotel Casey, Scranton, June 10-11.

New Jersey Utilities Association—Spring Meeting, Seaview Country Club, Seaview, N. J., May 14.

Interstate Power Club of New York—May Meeting, Hotel Martinique, New York, May 17.

American Public Power Association—Annual Convention, Broadmoor Hotel, Colorado Springs, Colo., May 17-19.

Public Utilities Advertising Association—Annual Meeting, Hotel Cleveland, Cleveland, Ohio, May 27-28.

American Society of Refrigerating Engineers—Spring Meeting, New Ocean House, Swampscott, Mass., May 31-June 2.

Edison Electric Institute—Annual Convention, Hotel Traymore, Atlantic City, June 1-3.

Arkansas Utilities Association—Annual Convention, Arlington Hotel, Hot Springs, Ark., June 14-15.

Pacific Coast Electrical Association—Annual Meeting, Fairmont Hotel, San Francisco, June 16-18.

Canadian Electrical Association—Annual Convention, Manoir Richlieu, Murray Bay, Province of Quebec, June 16-19.

American Society for Testing Materials—Annual Meeting, Book-Cadillac Hotel, Detroit, June 21-25.

American Institute of Electrical Engineers—Summer General Meeting, Palace of Fine Arts, Mexico City, Mex., June 21-25.

Providing New Equipment Next War's Big Problem

Production of electric generating equipment probably will provide the major problem in meeting national requirements in event of another emergency. That is a preliminary conclusion reached by government and utility industry experts who have been conferring recently with the National Security Resources Board in Washington. What to do about supply of heavy power equipment, however, is something else again, the specialists are convinced.

Falck to Make Formal Report

Preliminary reports of two advisory committees were received last week by Edward Falck, NSRB's chief consultant on utilities. The findings of these groups will be consolidated by Falck into a formal report to NSRB Chairman Arthur M. Hill. Though NSRB aides refused to comment on the work of the Utilities Section to date, it was learned that its major concern was for the ability of manufacturers to produce equipment necessary to maintain electric utilities on a war-time basis.

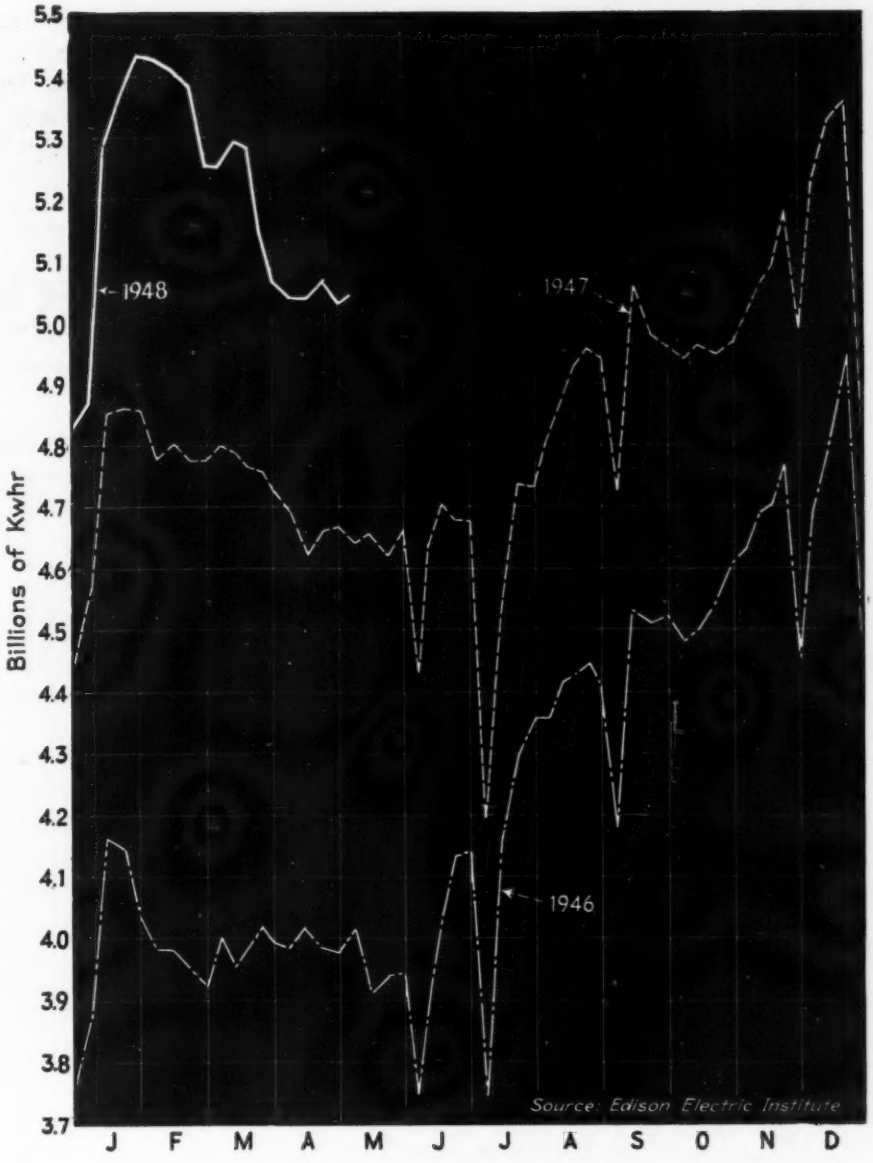
Practically the only decision reached in this connection so far was negative. The group apparently has ruled out any proposal that present orders for equipment be reshuffled. Practically all equipment on order is urgently needed, it was found, and any attempt at rescheduling probably would result in more delay and confusion.

Materials May Be Allocated

Possible needs of manufacturers for some form of allocation of raw materials also has been discussed, but the manufacturers themselves probably will be asked to report on that topic.

The two advisory committees now assisting NSRB are studying capacity and requirements of utility systems, and supply and production of power equipment. The first group is composed of J. E. Moore, Ebasco Services; V. M. Marquis, American Gas & Electric Service; Barclay Sickler, Bonneville Power Administration, and E. Robert de Luccia, Federal Power Commission.

On the second committee are Walker Cisler, Detroit Edison Co; Donald C. Luce, Public Service Co of New Jersey; Chandler W. Jones, New England Power Association; William S. Peterson, Los Angeles Department of Water and Power; Walton Seymour, Department of Interior, and W. A. W. Krebs, Atomic Energy Commission. Mark Eldredge, utilities specialist of the Munitions Board, and Charles H. Kendall, associate general counsel of NSRB, have been observers at the committee sessions.



Coulee Just a Bird Bath to Arput

Arput has joined the crusade for more hydro projects. He wants them from Maine to California. They're the nuts, he says. And the electricity they would supply—why Arput wouldn't build a dam for that. Bird baths and drinking fountains, he calls them all, from Grand Coulee to Conowingo. "Best snort I ever had was out at Coulee," he gurgles. "And those chickadees that hang around TVA," EW's output editor let out a low, leering whistle. What about steam plants? "Try drinking discharged cooling water," he fumed. "You can have it, it's too hot for me. Even a fish won't live in it." And output last week went up a little.

Other News

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Weekly Output, Millions Kwhr

1948		1947		1946	
May 1	5,042	May 3	4,640	May 4	4,012
Apr. 24	5,027	Apr. 26	4,668	Apr. 27	3,977
Apr. 17	5,087	Apr. 19	4,660	Apr. 20	3,987
Apr. 10	5,033	Apr. 12	4,620	Apr. 13	4,015
Apr. 3	5,037	Apr. 5	4,693	Apr. 6	3,988
Mar. 27	5,065	Mar. 29	4,729	Mar. 30	3,992
Mar. 20	5,145	Mar. 22	4,759	Mar. 23	4,017
Mar. 13	5,285	Mar. 15	4,764	Mar. 16	3,988

Percent Change from Previous Year

	May 1	Apr. 24	Apr. 17
New England	+ 3.9	+ 3.4	+ 8.3
Mid-Atlantic	+ 6.8	+ 5.9	+ 9.0
Central Industrial	+ 7.5	+ 6.3	+ 8.4
West Central	+10.4	+ 6.8	+ 6.3
Southern States	+11.9	+11.7	+12.7
Rocky Mountain	+12.8	+12.7	+12.1
Pacific Coast	+ 8.0	+ 7.0	+ 6.1
Total United States	+ 8.7	+ 7.7	+ 9.2

WASHINGTON COMMENT

WILLIAM B. WHICHARD

A SORT OF "who-put-the-overalls-in-Mrs -Murphy's-chowder" type of debate has arisen from the President's reappointment of members of the Atomic Energy Commission. It has more sober overtones, of course. But the mystery of "who put politics into the atom" probably will remain just as inscrutable to the general public for months to come.

After last summer's Senate dogfight over temporary appointments of Chairman David Lilienthal and the other atom commissioners, AEC's political fortunes took a phenomenal turn for the better. Senate Republicans of the stature of Vandenberg, Milliken and Hickenlooper made it plain they would abide no partisan nonsense on matters affecting the atomic development program. This sponsorship extended a non-partisan blanket over AEC and its activities. And it was so effective that no legislative attempt to revamp the Atomic Energy Act—and there were many efforts to make drastic changes—got formal hearings before the Joint Congressional Committee set up to handle such legislation. (One bill, permitting investigation by FBI of new AEC members, went to the President this week.

In Washington, at least, control of AEC suddenly is a top election campaign issue. If the Republicans fail to confirm the reappointments as they were filed by the President, they will be charged with disrupting atomic development for the sake of politics. Meanwhile, GOP spokesmen are trying to pin the blame on the President, who, they claim, made the reappointments without even token consultation with Republican leaders.

There is damaging evidence to support the Republican charges. It was a common knowledge that the White House had been considering the AEC appointments for weeks, perhaps months. And few fair-minded critics found fault with the decision to seek something more than interim appointments to keep the Commission intact until after the November election. AEC simply cannot function under short-term management.

Obviously any reappointment of Chairman Lilienthal, the center of last year's Senate row, for a lengthy term would lead to the same kind of confirmation fight. There are hints that even AEC itself expected Mr. Truman to give the Chairman a short term—three years, at most. Apparently the White House did not consult AEC, either. Such consultation usually is a political "must."

Just a few hours before the reappointments went to the Senate, the President talked with Sen Hickenlooper, Chairman of the Joint Congressional Committee. Yet, on his return to the Capitol, the Iowa Senator expressed surprise—even dismay—when told that Lilienthal had been named for the five-year term.

Then there are the persisting reports on remarks attributed to certain White House advisers—the men who have the most to say about appointments. These aides are quoted as "hoping" the GOP-controlled Senate would reject the reappointments and give the administration a "good campaign issue."

TECHNICAL TRENDS

ARCHER E. KNOWLTON

New synthetic rubbers of the "gee whiz" type, now just offstage, may make earlier appearance as a result of the law ending wartime patent pool.

Cable salvage by Boston Edison pays dividends. In ten years, company has processed 370,000 ft of cable, junked only 10%. Of that salvaged, 250,000 ft was approved for re-use at rated voltage, 83,000 ft derated in voltage for further service.

Tabulating machines are in increasing interest where they can be used for multiple purposes but seem to be less readily justifiable for accounting or meter test and history application independently.

Atomic power plants will need operators. Opening in July, with 5-months' terms, is a new engineering practice school at Oak Ridge for M. I. T. graduate students. Course will utilize gaseous diffusion and electromagnetic plants and Oak Ridge National Laboratory.

Cooling towers for most British power plants appear to be of the sheaf-of-wheat natural-draft design. Interest here favors mechanical draft. Where well-water is relied upon there is growing concern about make-up. Designs to function well in strong prevailing winds are attracting interest. Cooling make-up may be 50% greater than steam make-up.

Interfacial tension is a comparatively new test for condition of oil. Oil on troubled waters increases the surface tension and dampens the waves. But water, conversely, weakens the surface tension of oil. The test affords an index of oxidation products.

Meter sockets are essentially permanent installations. Most utilities apparently provide them and capitalize them. A few even install them. Some large utilities do not provide them and do not capitalize them.

Impulse strength of switchgear components is being enhanced and necessitates increased clearances for disconnects, current transformers and other auxiliaries. That makes a review of dimensions, particularly bases, desirable.

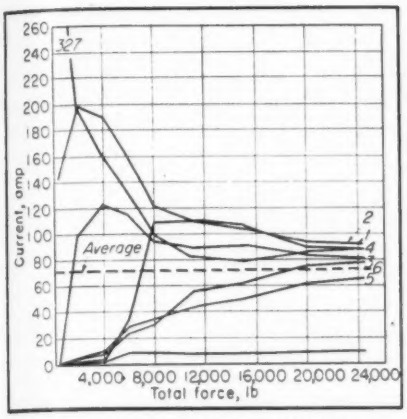


FIG 1—THREE STRAND WIRES of a 2/0-7-strand heavily oxidized conductor, carried most of the current at 4,000 lbs force

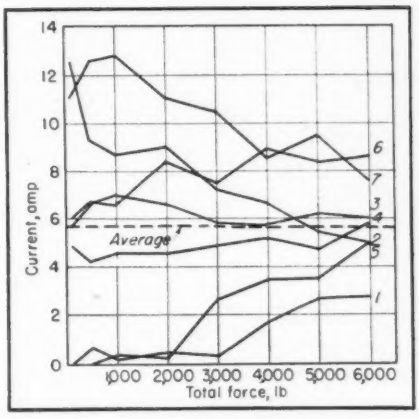


FIG 2(a)—FAIR DISTRIBUTION was obtained at 5,000 lbs force on this sample of 1/0-7-strand weathered conductor

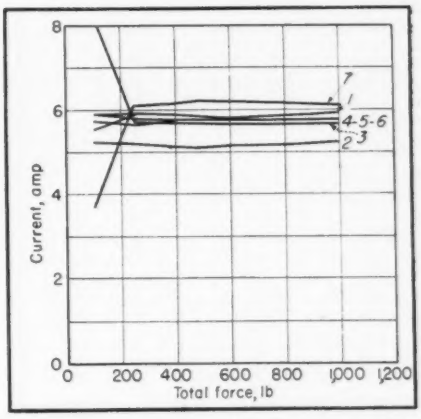


FIG 2(b)—EXCELLENT DISTRIBUTION of current at low pressure resulted after the same conductor was thoroughly cleaned

Wire Connections Need More Attention

High inter-strand resistance shown as source of possible trouble in wire connections. Adequate connections depend on pressure to develop low resistance and to exclude oxide formation on contact faces that comprise the connection

FRANK E. SANFORD
Director of Research and Development
Copper Wire Engineering Association
Chicago, Ill.

MECHANICAL CONNECTION devices used on stranded copper conductors should establish low contact resistance not only between the conductors but also among their component strands. Unequal flow of current in adjacent strand wires, at the connection, introduces a condition that may lead to arcing and failure under fault currents. This is similar to the more familiar trouble with switch contacts.

Considerable pressure is required on all of the strand wires to initiate and to preserve contact areas. Connector effectiveness can best be defined in terms of resistance, and performance may be specified on this basis. The current carrying capacity of the connection should be consistent with that of the conductors.

No connection device can, however, effectively connect conductors that are coated with surface deposits of dirt and oxidation compounds. A good connection may be made without difficulty on copper conductors when they are first installed, but cleaning is essential on weathered conductors in service. After connections are complete, positive pressure is needed on all the contact surfaces to prevent mechanical movement and possible encroachment of the insulating oxides.

There have been a few reports of trouble with mechanical connectors of the bolted type, such as that published in ELECTRICAL WORLD, Jan 31 and Feb 14, 1948. Copper Wire Engineering Association has sponsored a study to determine the cause and to suggest a remedy, as a part of its research program to assist the users of copper conductors to obtain maximum performance. The laboratory investigation was conducted by Armour Research Foundation of Illinois Institute of Technology.

Connectors Extensively Used

Bolted-type connectors have been used in overhead line construction for the past 15 or 20 years. Today millions of connectors have been in trouble free service for many years. Bolting has not, however, replaced compression and other types of sleeves used where high tensile strength must be developed.

The most extensive use of bolted connectors was originally for the smaller solid sizes of wire. During the past 8 or 10 years such designs have been extended to the larger stranded conductors. Recently there have been reports of failure or burning which might indicate that an inadequate connection is obtained with some of these larger connector sizes.

The wide and growing acceptance of bolted connectors for the larger sizes, paralleled with a few but increasing number of trouble reports, suggests the need for further consideration of basic and minimum requirements. There has been a tendency, for example, to increase the mechanical size of the connectors in direct ratio with the size of the conductors for which they are designed. The electrical requirements for contact and the mechanical effectiveness in producing contact do not appear, however, to follow this direct size relationship.

There has been no extensive survey of overhead line experience with

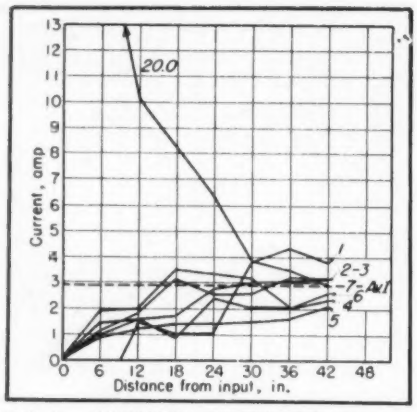


FIG 3—UNEQUAL CURRENTS flow two or three feet before accidental interstrand contacts bring better distribution if good contacts are not established at the connection on weathered conductor

connectors. However, several companies have made field and laboratory investigations following adverse experiences. These investigations have led to adoption of heavier mechanical connectors and instructions to clean wire in service when new connections are made.

Failure or serious burns at connections have been associated with fault or short-circuit currents. Normal load currents appear to cause overheating or annealing troubles only after damage by the higher current. However, test failures at values as low as 3,000 amp on 1/0 conductor indicates that the fault currents need not be as high as commonly expected to cause trouble. High joint resistance is considered the primary factor, and it is attributed to oxidation and dirt within the connection surfaces.

Current Distribution

An initial objective in this investigation was to determine the factors which might contribute to a connection failure and explain the serious conductor damage that may follow. A study to determine the effects of oxidation and other deposits on current distribution among the strand wires at the connection appeared to be the best approach. Sections of conductors that had been in line service, under varied conditions of exposure and for differing lengths of time, were obtained from several parts of the country for these tests.

Connector application should be based on the fact that discoloring surface coatings may grow on any surface that is exposed or to which "breathing" is possible. Exclusion of oxygen and other gases in the atmosphere is made most effective with a strong pressure on the contact area. An important conclusion from these tests is, however, that equal current distribution is not developed among strands, that are already heavily coated, with any force within the usual range of bolting pressures.

Current distribution results obtained in several of the tests are shown in accompanying figures. Variations in the general pattern, with clamping faces of various shapes and sizes, were surprisingly small. Some of the wire samples were more heavily coated and forces of 12,000 lb and higher were required to obtain current distribution that was equivalent to that shown. With the usual pressures, current values in adjacent strands differed by as much as 10 or 20 to 1. With clean copper wire, current distribution equalizes with much lower values of total force applied to the clamps.

Clamping faces of various shapes other than circular have been suggested to give abrasion of the strand surfaces. They appear to offer some advantage in developing distribution at moderate pressures, but the pressures required appear to be beyond the bolting range for equal values on badly-coated wires. Compression sleeve connectors designed to develop mechanical strength equivalent to the conductor use pressures that may be sufficient under these conditions to create new contact areas.

Current readings in this group of tests were taken one foot from the point of clamping, and should give somewhat better distribution than would be obtained immediately adjacent to the clamp. Transfer of current along the conductor, through inter-strand contacts, is shown in Fig 3. No pressure was applied in this test, and current was supplied to one-strand wire only.

Current values were obtained from milli-volt measurements across needle point contacts. Small total currents were used after it was shown that current magnitude did not affect the distribution results on a percentage

Conclusions Of Investigations

1—Mechanical connectors for application on copper conductors of overhead lines should develop contacts such that resistance through a section including a connection does not exceed that of an equivalent length of conductor. Conductivity of the connection should equal that of the conductors.

2—This investigation, as well as examination of connections that have caused trouble in service or which have failed in tests with fault currents, indicates that high resistance between individual strands and layers of strands in one conductor, rather than high joint resistance between conductors alone, is the principal source of trouble.

3—A positive-pressure low-resistance contact must be established, to and between all strand wires at the connection, to withstand fault current conditions. Connector effectiveness can be defined in terms of connection resistance of individual strand wires entering the connection.

4—Mechanical stability is essential for the preservation of contact areas. Connector pressures must be sufficient to prevent shifting of these surfaces due to conductor movement.

5—Initial tarnish films on copper conductors do not interfere with good connections at the time of original installation.

6—In making connections to conductors in service, where exposure has resulted in discoloring surface deposits of dirt and oxidation compounds, cleaning should be adopted as a regular practice. Removal of these insulating compounds is essential in establishment of good contacts.

7—There is a very definite need for development of a chemical cleaning grease or paste for practical overhead line use, to replace acid solution or scraping methods.

8—An oxidation inhibitor or sealing treatment, not water miscible, is desirable as an aid in preserving connections. It should not, however, be considered as a substitute for positive pressure contacts, since a poor connection cannot be made good simply by covering.

basis. High a-c values also gave distribution of the same order.

Cause of Failures

Two factors in the test data are of special importance in considering the action of fault currents: (1) Unbalanced currents may flow in several feet of conductor adjacent to the connection; (2) There are at least point, or high resistance, contacts to all strands, at or near the connection, as shown by a current flow in each strand.

An equivalent circuit diagram of a connection as indicated in Fig 4, helps in considering the reasons and effects of current unbalance. Direct contact, under force, is made from the connector to only part of the strands in the figure. Current in the remaining strands must then follow paths of contact to adjacent strands before flowing through the connection to the second conductor.

With force applied over a short length of conductor, there may be as many as three or four strand wires of a seven-strand conductor that are not included in the direct pressure of the connection. Contact is through a single or a few small spots or metallic bridges between the high-current and low-current wires, and these paths of current flow have relatively high resistance.

Normal load currents may be carried without apparent difficulty. Short circuit or fault currents impose conditions, however, which are similar to those in welding immediately after the arc is drawn, or in switching contacts as they are opened. For example, a fault current of 1,000 amp, dividing between two adjacent strand wires, could, under conditions shown in the current distribution tests, result in fusion of one-half the diameter of the strand at the point of contact in one-half sec. A sustained discharge results from the 1 to 3-v potential difference between adjacent strands, not accompanied by movement or drawing out of the arc. The small but inadequate contact is actually worse than complete insulation of the strands which are not carrying their share of current, because in that case a breakdown potential of 300 v or more would be necessary to start the arc discharge.

Examination of connections that have caused trouble in service or which have failed in tests with fault currents, gives a further indication of the similarity to arcing or welding action in a high resistance connection. The high temperature causes alteration of the copper at the wire surface, with formation of large crystals and the release of large grains. The altered crystal structure extends to depths of several mils, with erosion and material transfer similar to that noted in severely arcing switch contacts. The heating effect of a 15,000 to 20,000-amp fault current would be 45 to 80 kw in a connection with resistance 200 microhms in excess of the equivalent wire length.

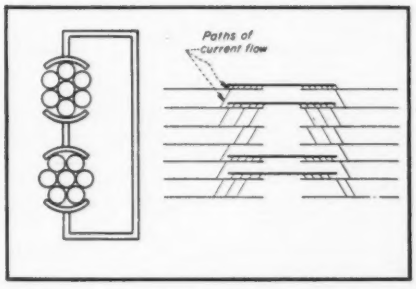


FIG 4—CURRENT MUST flow through contacts between adjacent strands when the pressure connection is over a short length of conductor. Direct pressure contacts, wire to wire or through the connector body, are shown by the heavy lines in this equivalent circuit diagram

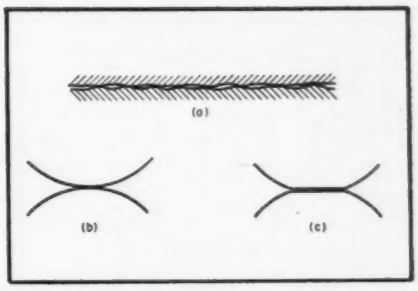


FIG 5—SPOT CONTACTS (a) initiate a connection before pressure is applied, as represented in this magnified view; (b) contract is through a line only with low pressure on the round wires; (c) yielding or lateral deformation under pressure results in an increase of contact width

Contact Pressure

The usual tests of connectors have centered on the *normal* current carrying capacity requirements, and with temperature rise on the surface of a connector or clamp. This has a direct bearing on its use for indoor service, and it is a good indication of a low resistance joint. Some devices may, however, radiate enough heat to maintain a normal temperature even though the internal contacts are not sufficient for fault currents. Connections should not impose a limitation on an overhead line, and they can endure operating temperatures as high as are permitted for the conductors, if the contacts are good from the beginning.

It is apparent from the current distribution study that, in the application of connectors on stranded conductors, good contacts must be made among all strands of each conductor at the point of connection. Full use of only part of the strand wires in the vicinity of the connection may seriously de-rate the safe carrying capacity of the conductor. Further, a partial contact to some strands increases the hazard of arcing and burning with currents of fault magnitudes.

Many aspects of electrical contacts have been extensively investigated in the fields of circuit breaker and other switching or moving member designs. The physical and chemical problems involved in establishing and maintaining a positive connection are much more intricate than in the case of stationary contacts.

High contact pressures on relatively small contact areas are generally accepted as preferable to the reverse basis of design. Special attention has been given to the contact surface, with cleaning of busbars at joining ends, and with silver or other surface treatment of switch contacts. In the case of wire contacts, less consideration has been given to these practices.

The mechanical problem of establishing a contact area on the surface of a round wire is illustrated in Fig 5. Pressure applied to the wires must create a continuous line of contact between two surfaces which are not of polished smoothness. At low pressures the contact consists of several small spots, as shown in magnified form. As the pressure is increased, yield of the copper or lateral deformation is visible and the width of contact increases as a function of the pressure.

Contact resistances provide a good measure of this action in initiating a connection between two wire circumferences. Curves of connection resistance versus pressure for hard drawn wire to wire contact and wire to

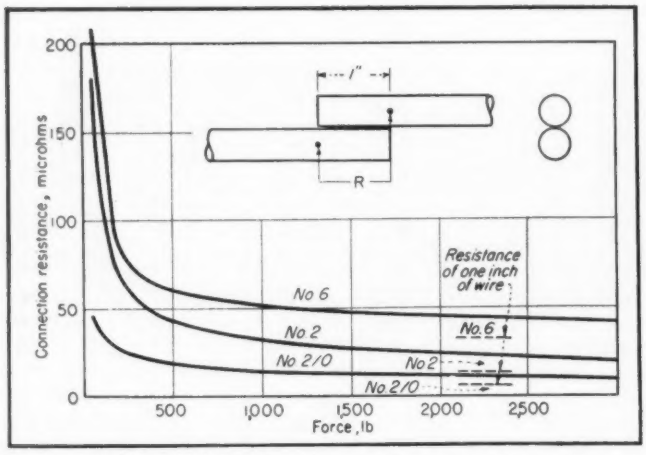


FIG 6—RESISTANCE of the wire to wire contact shows effect of pressure in creating a line and then an area of connection

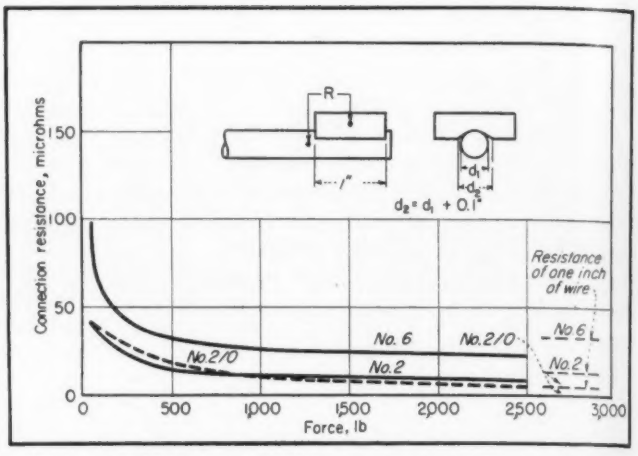


FIG 7—CIRCULAR GROOVE contacts of the connector body or spacer bars aid in establishing contact and reducing resistance

circular groove bar contact, in each case one inch in length, are plotted in Fig 6 and 7. Three characteristics apparent from these data follow:

(1) Resistance drops sharply with increase of initial forces, up to about 300 to 500 lbs. Above these values, which do not vary greatly with wire size, the resistance values change gradually with further increases in force applied. With two lines of contact to each strand wire in the connection, resistance values can readily be made less than equivalent lengths of conductor.

(2) Much lower resistances are obtained with the bar contact than with the wire to wire contact at equal forces. Connector bodies, without spacer bars, may carry more of the total current than the wire to wire contact, if conductivity of the body, bolts, etc, is sufficiently high.

(3) Values of force in the "knee" sections of the curves represent relative instability. Contact pressures must be maintained well above the critical values where some yielding of the wire-to-wire contact surfaces gives a flat area, to insure against shifting due to movement of the conductor.

With a very small part of the wire circumference in actual contact, a slight movement of either wire can displace the initial clean areas and bring each into contact with an oxidized surface, and in turn permit exposure of the clean area. This appears as the principal reason for increases in connection resistances in service. Forces high enough to press out the waviness, represented in the magnified view, are also essential to prevent "breathing" into the contact faces.

Translating these unit pressures for solid conductors into forces required for two stranded conductors, introduces another factor. Contact lines between the various strand wires are at several angles from the direction of applied force, in the usual types of bolted connectors. Strands lying parallel to the line of force may have pressures as low as 25 % of the pressure on strands directly in line. Consideration of this part of the problem of adequate connection may lead to the conclusion that length of the connection device must be sufficient to bring all strands into the direct line of applied force. This would relate the length to the lay of the stranding, which is in turn related by standard to the conductor wire size.

Nature of Oxide Formation

1—Surface or tarnish film appears on all metals upon exposure to the atmosphere. This film becomes a protective coating on copper, to prevent destructive corrosion during hundreds of years of exposure. But the qualities that resist weather attack also resist electrical contact.

2—Initial tarnish films on copper are relatively thin, and pressures that are large enough to maintain the contact are sufficient to break through the early film.

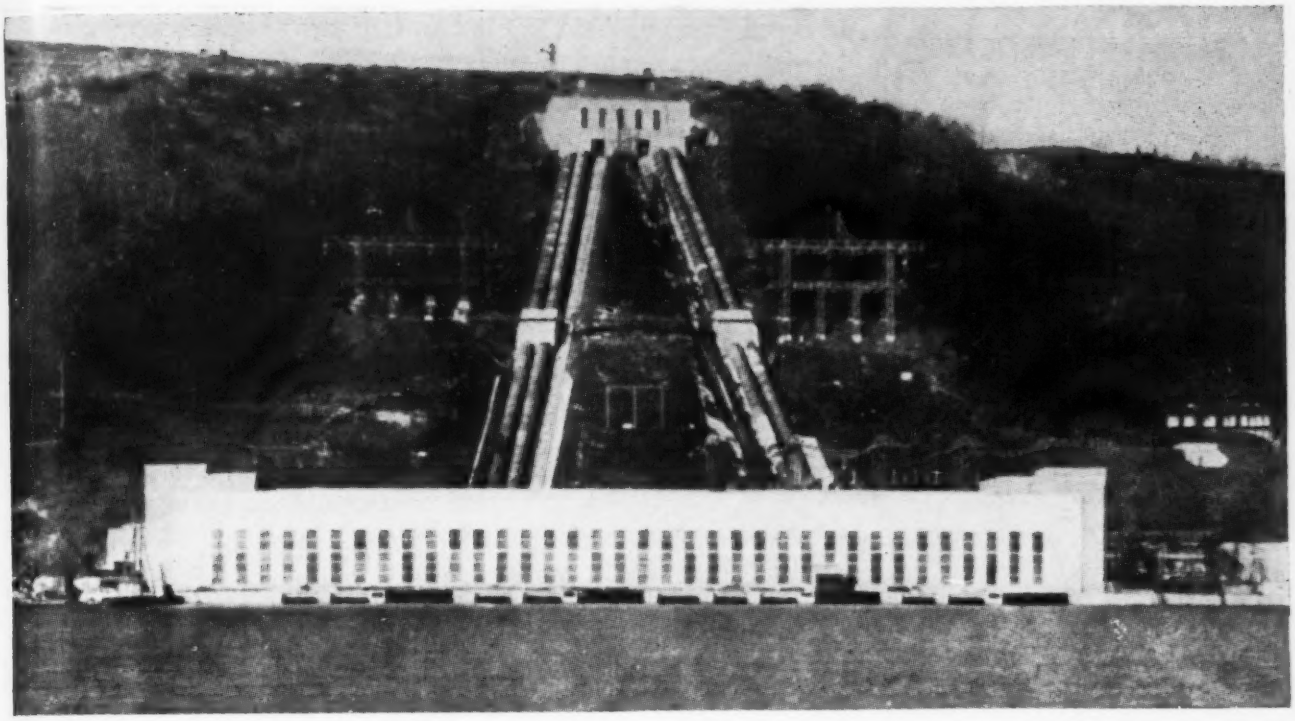
3—It is ordinarily some time after copper has been exposed in service that the oxide films grow or are coated with other layers or mixtures sufficient to cause the familiar black, green or blue tinted deposits.

4—Surface films grow by diffusion of metal atoms from the outer surface outward to join with oxygen and other gas atoms from the atmosphere. Oxygen does not penetrate into the copper to form oxides at ordinary atmospheric or operating temperatures (i.e., under 1,000 deg F).

5—Contacts held together by connector pressure are not harmed by growth of oxide films on the surfaces outside the contact area.

6—Formation and removal of the surface films do not alter the conductor to any practical extent since the layer of copper involved is of multi-molecular thickness only.

The principal mechanical problem in maintaining contact appears to be to prevent twisting or shifting movements due to conductor movement at the connection. Creep of the metal is practically without importance in copper contacts although it may be disturbing with some other metals. Relaxation of copper and the copper alloys used in connectors, resulting in some loss of pressure after initial tightening, are ordinarily not large in percentage and are within a reasonable factor of safety allowance in the design.



HERDECKE PLANT on the Ruhr with 194,000 hp is largest existing pumped storage hydroelectric station. It is of daily pumping and regenerating type, has pond capacity of 1,300 acre-feet and has head of 540 ft. Each of 4 sets of machines consists of a spiral turbine, a pump and electric unit that serves as a motor when pumping and a generator when regenerating. Between each pump and electrical machine a coupling is installed for the purpose of connecting and disconnecting the pump

Pumped Storage Hydro Costs Per Kw Are Competitive

Costs up to $255 per kw can compete with steam when pumping energy is from off-peak steam; surplus hydro is even more attractive

DR N. N. WOLFF
Hydraulic Engineer
Chicago, Illinois

SINCE THE DEMANDS for electric power have increased so rapidly in recent years and will probably continue to increase, now is the time to analyze the economics and operating advantages of all types of stations. Much has been written about steam and hydro plants. But little has appeared about the pumped storage hydro-electric plant.

The pumped storage hydro-electric plant is well known in Europe. About forty such plants with a capacity aggregate of more than one million kilowatts now exist. More of these have been operated with great success through the years and have proved their economic practicability. The first large plant of this type in the United States is the Rocky River hydro electric plant in Connecticut.

Since the construction of these pumped storage plants, the efficiency of pumps has been increased from about 75 to 86% and the efficiencies of turbines raised to above 90%. These improvements have increased the overall efficiency of pump storage plants more than 15%. Even before these improvements, European engineers found it economical to develop locations and construct plants with capacities as small as 292 hp and as large as 194,000 hp. As shown in the table of pumped storage plants, effective heads ranging from 135 to 2,9000-ft have already been built. Recent investigations indicate that under certain circumstances plants with heads of 60-ft can be economically constructed.

These plants are of various types to accommodate local operating conditions. Most of them are of the daily pumping and regenerating type. But some conventional ones have seasonal storage. These are connected with systems having hydro and steam plants.

Pumped storage plants have certain specific advantages. They are

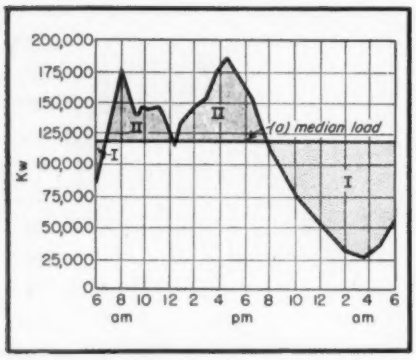


FIG 1—PUMPED storage plant taking peaks during day, regenerated during night. Area I is pumping, Area II regenerating

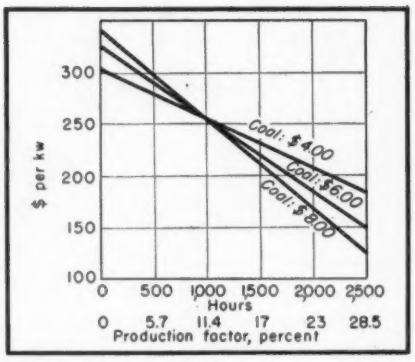


FIG 2—CAPITAL INVESTMENT economical limit increases with higher cost of coal and lower production factor

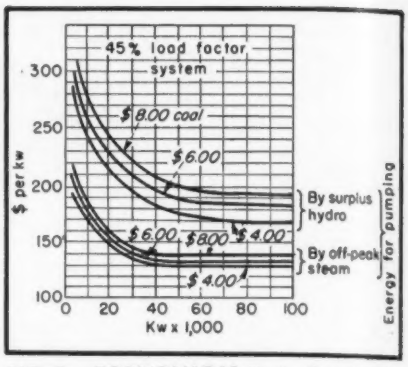


FIG 3—ECONOMICAL limit of capital investment per kw is higher when energy supply is surplus hydro than off-peak steam

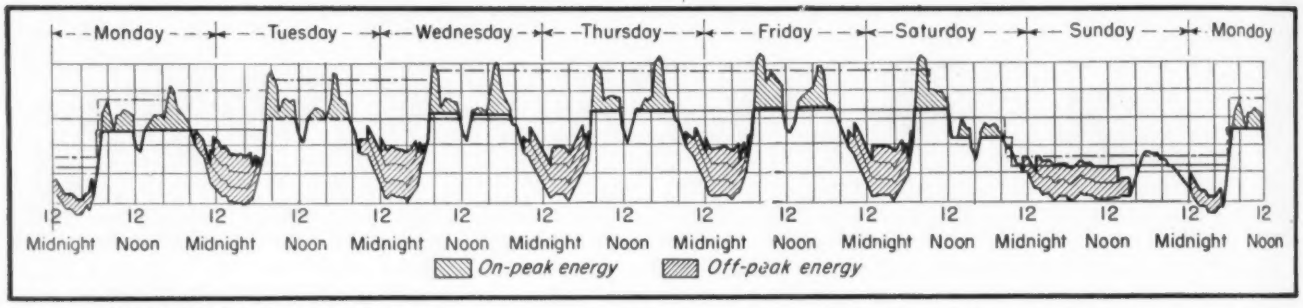


FIG 4—OPERATING ADVANTAGES of pumped storage extend throughout the week. Not only takes weekday morning and evening peaks but makes it possible to cut back steam earlier Saturday and keep it down until Monday morning. Saturday afternoon and evening peaks and Sunday evening peak are supplied by pumped storage capacity

relatively cheap to construct since no expensive river work is necessary and dams, for the most part, are low and small. The plants are independent of rainfall. By this is meant that water is simply pumped from a lower basin to an upper basin and then re piped through the machine for regenerative purposes. In this basic cycle, the only water loss is from evaporation and seepage. On the basis of overall volume of water, the percentage loss is small. Suitable sites are easier to find in the vicinity of power lines and power stations. It is possible to construct a pumped storage plant in locations where it has been considered impossible to develop conventional hydro plants.

When a pumped storage plant is interconnected with a steam plant, the economy of the latter is greatly improved. The steam plant can be operated nearly to the availability factor. Using it as a base load plant, the overall efficiency is higher, and the cost consequently can be reduced.

Pumped storage plants are a relatively inexpensive way to supply standby service in case of emergency. They can take the place of fuel units whose boilers must otherwise be kept under steam.

The low valuable off-peak energy of a steam plant can be converted into high value on-peak energy. When a pumped storage plant is connected with a run-off river plant, the hydro energy otherwise spilled over the dam can be used to obtain valuable on-peak capacity. The effect of a pumped storage plant on a winter-day load ourve on a typical medium-size utility system is shown in Fig 1. This system has a yearly output of 360,000,000 kwhr. The on-peak and off-peak energy balance with regard to operating loss.

Storage Adds Availability

The minimum load is 27,000 kw, the maximum, 189,000 kw. If no pumped storage energy were available on this system, the basic plant would be required to cover the maximum demand and the peak load generating equipment would be producing at full productive capacity only a small percentage of the time.

With a pumped storage plant, the basic plant could be of lower capacity and could be operated with nearly full availability. In Fig 1, (a) is the line of medium load if daily pumping and regenerating is effected. Area I indicates the energy needed for pumping. Area II indicates the energy obtained by regenerating. The sum of area I is larger than the sum of area II. The difference is operating loss.

But, since the area indicated by II is available at peaking periods, it is much more valuable than that indicated by Area I. Fig 4 indicates the changes in the basic station load curve contour on a system, with and without adequate pumped storage plant capacity.

The economical limits of the capital investment per kw for various production factors and coal prices when comparing a storage plant with a steam plant are shown in Fig 2. This graph is only a rough guide, as some costs depend largely on local conditions.

In this graph it is assumed that a pumped storage plant of medium size in a metropolitan system has a load factor of 45% and should be in competition with a steam plant for the upper portion of the annual load curve. It is also assumed that all pumping is done by steam off-peak energy. The price index utilized is that of January 1948. The calculations are based on the principle that cost per kwhr of a steam plant is not more than that of a hydro plant.

An equation dividing cost per kwhr of a steam plant in fixed charges, constant production cost and incremental energy cost, and of the hydro plant in fixed and production charges, was set up. Fig 2 is the result of the calculations utilizing that equation. The curve is a function of construction cost and coal price for January 1948 and indicates the cost limits per kilowatt of a pump storage plant at the various production factors in comparison with a steam plant.

The curve shows that at 1,000 hr annual use (a production factor of about 11.4%) the installed cost limit per kw can be as high as $255. At a lower production factor, this limit could be higher; at a higher load factor, it could be lower. Since the production factor is generally between 5 and 15%, $255 per kw gives an approximate idea of the economical limit of a pump storage plant of medium size.

The reason for the increasing cost limits on the left side of the production factor of 11.4% (1,000 hr annual use) and a decreasing limit on the right side is the cost result of switching boilers on and off for short period. Relatively, this costs more money than keeping boilers under steam for longer periods. The higher the price of coal, the higher the limit for a short production factor.

Another approach to the analysis of the same problem is given in Fig 3. The factors considered in drawing this nest of curves for the economical cost limit of a pumped storage plant versus steam plant as a function of the size of the plant and the coal price are given by Markwart in American Society of Civil Engineers Transactions, volume 94, page 911. They are that the economic limits for capital expenditures for a pump storage plant is the capitalized annual charge of a steam plant operating under similar load conditions as follows:

(1) In the event that off-peak energy is supplied by a run of hydro plant, the limit will be the annual cost of a kilowatt year of equivalent steam power (alternate steam peak load plants) capitalized at the annual percentage charge of a hydro electric plant;

(2) In the event that the off-peak energy is supplied by steam plants, the limit will be the annual cost of a kilowatt year of equivalent steam power minus the annual cost of fuel burned to supply a kilowatt of pumped storage peak capitalized at the annual percentage cost of a hydroelectric plant.

List Of Pumped Storage Plants

Name	Capacity HP	Head Ft	Upper Reservoir Acre Ft
UNITED STATES			
Rocky River, Conn.	32,000	230	140,000
Lake Lamoka, N. Y.	2,500	396	4,700
SOUTH AMERICA			
Maitenes, Chile	3,000	233	
EUROPE			
Tuebingen	292	375	5.5
Uberlingen	600	305	1,240
Zweribach (Industrial Plant)	800	1,500	5.5
Reutlingen	2,000	400	33.5
Mittweida	2,250	390	180
Friedingen	2,250	530	26.5
Tremorgio	12,000	2,900	Lake Tremorgio
Helm Furth	23,580	135	
Schwazembachwerk	62,500	740	12,500
Niederwartha	120,000	435	
Schluchsee	184,000	656	
Herdecke	194,000	540	1,300

Metropolitan System

The nest of curves in Fig 3 are applicable to a metropolitan system with a 45% load factor. For the upper curves the off-peak energy is assumed to be supplied by surplus hydro; for the lower curves, by off-peak steam.

For a plant of 30,000 kw and a coal price of $6 per ton, the cost limit is $210 if surplus hydro is utilized, and $140 if off-peak steam is supplied. These are 1930 prices. The 1948 prices are even more favorable. The total price increase from 1930 to 1948 can be assumed to be 70% for steam.

Utilizing this percentage and the previously referred to economical limit figures, this would increase the economic limit with prices as of January 1948 to $357 per kw if surplus hydro and $238 if off-peak steam were supplied.

As shown in Fig 2, the limit is $238 at a production factor of 15%. The curves therefore appear to be in accord. The limit of $255 per kw previously mentioned is that for a different production factor (11.4%). The lower the production factor the higher can be the cost limit.

A number of sites in different areas in the United States have been investigated and preliminary studies completed. These studies show that there are many sites suitable for pump storage plants and that the construction costs of these plants would be far below the economic limit previously mentioned.

Some figures on a project recently completed will bear out these factors. The site is located on a river with ample pondage in the neighborhood of a large city and about 1½ miles from a transmission line. The available head is about 430 ft and the available storage about 550,000 kwhr. A high level reservoir on this site is obtained by closing off an adjacent valley with small low dams. The river is used as the tailrace.

The plant would supply a peak load of 25,000 kw for 20 hr or 50,000 for 10 hr. The site is estimated on a basis of (1) a complete structure for two 25,000 kw units and an initial installation of one 25,000 kw unit; and (2) for complete structure and immediate installation of two 25,000-kw units.

Analysis of (1) shows a total cost of $150 per kw; and (2), $110 per kw. Since in this project energy for pumping will be supplied in equal quantities from off-peak steam and surplus hydro, the $150 installed cost in the first study is approximately 50% below the economic limit. In the second study, it is 63%. This is an even more favorable operating condition.

Linoleum Ideal for Drafting Table Tops

To MAINTAIN a neat table top, drafting tables in Oklahoma Gas and Electric Co are being covered with white linoleum. The idea, developed by Albert Dorr of the engineering department, is reported to have five distinct advantages:

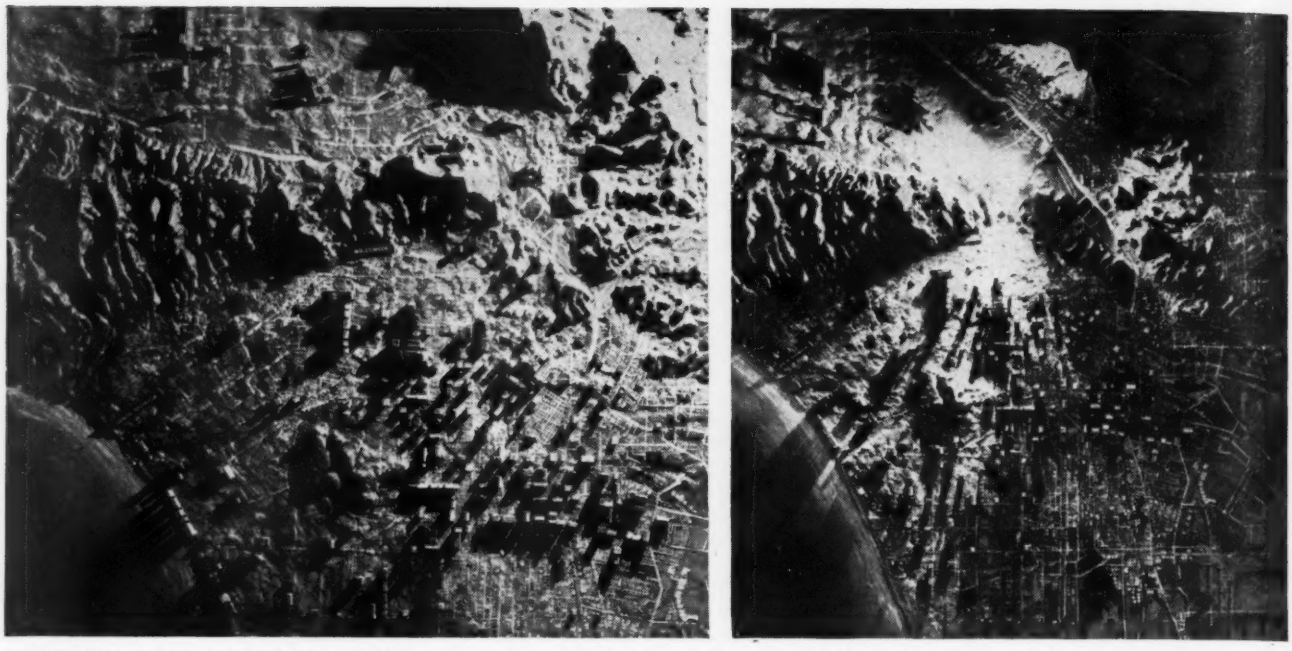
1—Has a smooth surface ideal for drawing.

2—Being white, eliminates need of covering table with heavy white or green paper.

3—Does not indent under drawing pressure as does wood or paper.

4—When soiled, is easily cleaned with damp cloth.

5—Costs about one-third price of new table tops and saves replacements.



SHADOWS CAST ON RELIEF MAP by automobile headlight bulb at site of transmitter give pattern of television coverage. Shown at left is downtown Los Angeles, Hollywood, Santa Monica, Glendale, and Burbank with bulb (transmitter) on 5,000 ft Mt Wilson back of Pasadena. Television coverage of Los Angeles from Mt Lee north of Hollywood is shown at right

No Television Interference

Los Angeles experience shows power lines cause no video interference. Novel use found for relief map in coverage surveys and as an aid in checking and planning antenna sites

I. L. BATEMAN
Asst Electrical Engineer
In Charge Of Operation
Los Angeles Dept Of Water & Power
Los Angeles, Calif.

UTILITIES MAINTAINING a radio interference service for the benefit of their customers are now beginning to have the problem of complaints regarding television interference. Over 9,000 television sets were sold and installed in the Los Angeles area during December 1947. This caused the television interference problem to come rapidly to the fore with the Los Angeles Department of Water & Power.

An aid was needed in discussing the line-of-sight characteristics of television radio waves and in explaining "ghost pictures" (double images caused by reflections from hills or buildings). A relief map was found useful for this purpose. An automobile headlight bulb is placed on the relief map at the site of the television transmitter. The shadows cast by the intervening hills and buildings conveniently outline the non-coverage areas of the high-frequency waves. It is necessary, of course, that the height of the hills and buildings on the relief map all have the same vertical scale. The scheme is convenient for making quick checks of antenna sites for radio stations operating in the high-frequency bands to show the areas which could be covered by direct line-of-sight signals. The accompanying photographs show two such relief map surveys.

In handling television interference complaints, the dealer has a definite responsibility to the customer for good reception. The charge made by the dealer for a satisfactory antenna installation at the time the television receiver is sold and installed assigns this responsibility. As a matter of good public relations, it has been found advisable to investigate television interference complaints received after the dealer has rechecked the installation for any necessary repairs or adjustments. In television reception, less interference from power system sources can be expected than in the regular broadcast band. This is because of the greatly reduced noise level in the high-frequency television bands.

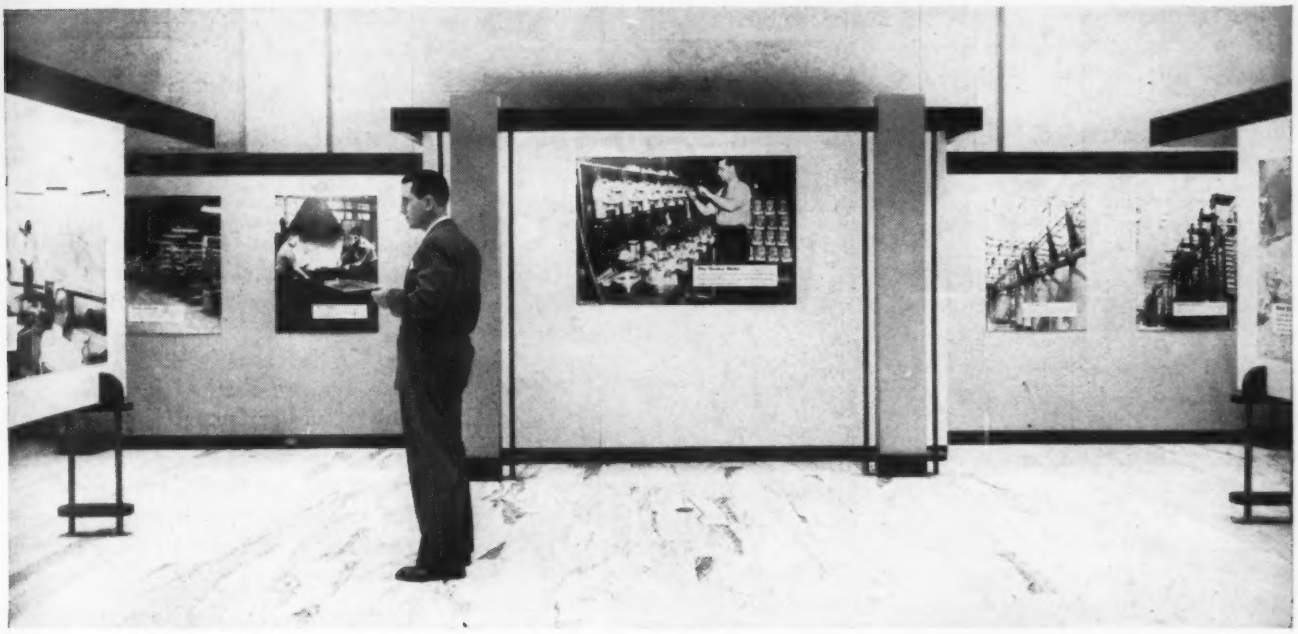
Some types of interference can be heard on the television loudspeakers. But, in general, it has been found that the effect of interference is much easier to observe on the television screen. The picture interference, consisting of distortion or erratic streaking of the received image, is usually caused by automobile ignition systems or by defective electrical apparatus and appliances. Contrary

to popular belief, power lines that are properly constructed and maintained do not cause interference on television frequencies.

Recently the department conducted a series of tests and observations near and under one of its 138,000-v transmission lines. For these tests, a nationally known table-type television receiver with a 7-in. viewing tube was used. With the receiver on the ground directly under the transmission line, and with an antenna less than 10 ft high, the program from television station KTLA on Mt Wilson 17 mi away, was received. Under such extremely unusual conditions, not only was proper reception obtained, but it was possible to photograph the interference-free image in daylight with only a black cloth thrown over the receiver and camera.

In order to show that the power system is not causing interference it is frequently necessary to work with the serviceman or dealer and assist him in running down and eliminating the interference at the source. Usually elimination of interference is possible by the installation of suitable filters. In many cases, the effects of noise may be eliminated by relocating the antenna or by using one with stronger directional characteristics. Building noises are overcome through an antenna with a shielded lead-in.

Radio interference investigations have been carried on by the Dept of Water & Power for over twenty years. During the past year, over 5,000 calls to investigate radio interference complaints on the broadcast band were answered. Only 130 of these complaints were caused by trouble traceable to power lines.



SCENES OF SYSTEM FACILITIES and personnel at work acquaint customers with what it takes to supply them with electricity

Pictures Tell The Company's Story

ROBERT M. ANGELL
Display Supervisor
New York Power and Light Corp
Albany, N. Y.

TO THE AVERAGE CUSTOMER, an electric service company consists of a monthly bill, the cashier who receives payment, an occasional line truck and a service man. Seldom does a customer see any of the personnel and equipment involved in providing electricity for his home.

New York Power and Light Corp, Albany, N. Y., recently attempted to remedy this situation. It added to its regular display program a series of large photographs of typical jobs, equipment, and installations. Although some unusual jobs are pictured, the emphasis is on the ordinary day-to-day work that supplies electricity whenever needed. Some electric services such as street lighting or special uses of electricity in industry or business are also included.

Photographs in the publicity department were combed for subjects. Many new shots were taken by company photographers especially for the displays. The pictures, with nontechnical captions, were then enlarged and mounted on panels.

Finished panels, in sizes 30 x 40 in. and 40 x 60 in., were placed on the display floor of the Albany office. Public reaction in Albany was so favorable that the displays are now routed to the 35 offices in the company's 14 districts. The usual time a group remains on a display floor is six weeks.

The following is a partial listing of the 38 picture subjects used:

- Brush cutter
- Central billing machine
- Circuit Breakers
- DC calculating board
- Ladder for cleaning street lamps
- Linemen's school
- Repairing transformers
- Storm damage
- Surveyors
- Transmission line patrol

Is Your Relay Test Program Realistic?

Pennsylvania relay engineers examine practices for relay test programs . . . Most programs call for annual testing but scope and comprehensiveness of tests vary widely

F. S. FEHR
Relay Engineer
Metropolitan Edison Co
Reading, Pa.

WHEREVER relay men gather, one of the important subjects discussed is that of testing programs. Their opinions are particularly strong on questions of frequency and comprehensiveness.

In an attempt to clarify practice among utilities in its state, the Pennsylvania Electric Association's Relay Subcommittee surveyed its membership on practices and criteria for relay test programs.

A summary of the replies shows these facts:

1. Out of 12 companies, ten use a basic relay test frequency of 12 months. One company uses 24 months and one company six months.
2. A majority indicate that their relay testing is done by specially trained technicians, many of whom are electrical engineering graduates or their equivalent.
3. Eight companies said that discrimination is used in scheduling relay tests. Higher voltage lines and generating stations receive preference to the lower-voltage lines.
4. All companies trip the breaker or breakers associated with the protective relays when they are tested.
5. In addition to regularly scheduled tests, four companies check relay trip circuits (actually tripping breakers) at intervals from one to six months.
6. All companies perform acceptance tests on new relays, and very complete installation tests made on all new protective relay schemes.
7. All companies check and test auxiliary relays along with their associated protective relays.
8. In a majority of cases current transformers and secondary cables are regularly tested and checked.
9. All companies make timing tests during scheduled relay inspection. These tests range from two or three points, to a curve from 150 to 1,000%.
10. Three of the 12 companies keep separate records to show the failures or potential failures of protective relaying schemes that are discovered during scheduled tests.
11. Two of the companies report that periods between scheduled relay tests will be extended. One company states that the period should *not* be extended. Several indicate that the frequency of tests is open.

Procedures Detailed

The accompanying check chart classifies replies of the various companies as to general testing practice. However, further details on the testing procedure of individual companies are illuminating.

Company No 1—At least three test points of relays, as found, and four or five points, as left, are checked at each 12 month inspection. All relays are set at 500% of tap setting. All relays are energized with approximate float current and oil circuit breakers tripped if possible.

Company No 2—During annually scheduled tests, relays are given an "as-found" check at 500% tap setting. A calibration check made at 200, 300 and 500% points.

Company No 3—Annual tests call for an as-found test by applying correct energizing components of current and/or voltage to determine if relay settings or characteristics have changed. Where possible a ratio check of the current transformers is made. While secondary current is flowing a voltmeter check is made of current transformer secondaries for loose connections, high resistance joints or defective conductors and to check on connected burdens.

Company No 4—Tripping tests are made primarily by spinning the relay disc or operating the solenoid by hand. Tests of the characteristic curves are not generally made. Two-year relay maintenance schedules have proved satisfactory, but it is believed that longer periods than this can be safely used where backup protection is available. We are planning to schedule overcurrent relays at unit substations, on a four-year basis.

Company No 5—The relay is given an as-found check which, for overcurrent relays, includes a complete calibration from pickup to 1,000% pickup. In the case of distance relays, all elements are checked for calibration at 50% power factor (X units at zero power factor).

Company No 6—Relays are checked for minimum pickup values of current, at 1½, 3, 5 and 10 times current tap setting.

Company No 7—Slow speed impedance relays are tested with and without voltage restraint. High-speed impedance relays are tested without adjusting phase angle of current and voltage applied to the impedance element, although the phase-angle is measured and recorded. Provision is made for controlled phase-angle tests on this type relay.

Company No 8—Approximately every five or six years a completely new time-current curve is taken over the range from 125 to 2,000% pickup.

Company No 9—In the past all line relays have been set from the current transformers. In the future, when this will expedite the normal testing or obviate overtime work, the setting medium will be applied to the relay. There will be exceptions as follows: All relays on 66 kv and higher will be set from current transformers with the OCB's cleared and tagged, all 26

Summary of Relay Testing Practices of 12 Member Companies of PEA

ITEMS OF TEST PROCEDURE	INDIVIDUAL COMPANY PRACTICE											
	Co 1	Co 2	Co 3	Co 4	Co 5	Co 6	Co 7	Co 8	Co 9	Co 10	Co 11	Co 12
I Basic Relay Test Frequency—Months.	12[1]	12	12	24	12[3]	12	12	12[3]	12[4]	12	12[5]	6
A—Relays Given Preference on Test Schedule												
1. Carrier Relays	√				√			√	√		√	
2. Transmission Relays	√		√		√		√	√	√	√	√	
3. Generating Station Relays	√		√		√			√	√			
4. Overcurrent Relays							√[6]				√	
5. Transformer Relays					√			√	√	√	√	
B—Supplementary Exercising or Breaker-Tripping Tests—Mo.			6[7]	3[8]							1–4	1
II Favors Extension of Relay Test Frequency	√[1]		See note 12	√	√[2]			√				No
III Testing Done by Specially Trained Technicians				√	√			√	√	√	√	√
IV Acceptance Tests Given All Relays	√	√	√	√	√	√	√	√	√	√	√	√
V Breaker-Tripping Tests												
As Found	√	√	√			√		√				
As Left	√	√	√	√	√	√	√	√	√	√	√	√
VI Comprehensiveness												
1. Contacts Serviced			√	√	√	√	√	√	√	√	√	√
2. Setting Points Checked	√	√	√	√	√	√	√	√	√	√	√	√
3. Complete Calibration Curve			√		√			√[11]		√		
4. Partial Calibration Curve	√	√		√		√	√		√		√	√
5. Auxiliary Relays Checked	√	√	√	√	√	√	√	√	√	√	√	√
6. CT. Secondary Circuit Meggered.	No	√[9]	√	√[10]	√		√[6]	No	√	No	√	√
7. High Pot Test of Relays	No		√	√	No			No	No	No		
VII Records												
1. Protective Relays on System				5,754			705	3,378				
2. Auxiliary Relays on System				1,510				2,609				
3. Protective Relays Inspected				2,820				1,632				9,447
4. Auxiliary Relays Inspected				714				1,444				
5. Protective Relay Failures				11			24	10				
6. Auxiliary Relay Failures								23				
7. Protective Relays Requiring Adj. or Repair								556				
8. Auxiliary Relays Requiring Adj. or Repair								152				

NOTES

1. Overcurrent and induction relays in heated locations, clean atmosphere, with good covers and felts need not be recalibrated for 4 or 5 years. But trip circuits should be checked and O.C.B.'s exercised annually at least.
2. Test all relays associated with circuit, generator, transformer, bus or other equipment when it is out of service for annual maintenance.
3. Schedule protective relay tests annually. Actual testing has been averaging 16–18 mo.
4. Relays on equipment operating 66 kv and higher as well as 26 kv ground and distance phase relays maintained annually. All others maintained once in two years.
5. Tests 66 kv pilot wire relays every 3 mo; 4 kv and 2.4 kv circuits biennially and 66 kv, 33 kv and 13.2 kv high tension customers biennially.
6. We let overcurrent relays go for 24 mo. CT's secondaries given resistance test at 5 year intervals.
7. Semi-annual trip tests include visual inspection of equipment without removing covers. Correct current and/or voltage applied to relay terminals to initiate relay action. Tripping circuits completed and relays energized to initiate complete tripping.
8. Tripping tests made by spinning relay disc or operating solenoid by hand. These tests applied at generating stations by test sets using minimum operating currents. These checks follow a calibration check as final certification of relaying.
9. Current cables meggered when O.C.B. is inspected normally every 3½ yr.
10. CT loop resistance test and insulation Meggering tests made every 6 years at outdoor stations; every 8 years at indoor. Pilot wire channels checked annually, by 500 v Megger and loop resistance tests.
11. At approximately five year intervals a complete time current calibration curve is taken from 125% to 2000%.
12. The frequency of testing is subject to controversy as sufficient data have not been correlated in respect to finding damaged and defective protective schemes in service.

kv ground relays will be set from the current transformer as before with the OCB open but not cleared and tagged as was previously. The new procedure will be applied to line phase relays on 26-kv, 13-kv and 11-kv systems. Tripping checks are made with the circuit or equipment energized providing no service interruption will result.

Company No 10— Values of test currents range from minimum pickup to at least 1,000% when possible. Each relay is then checked for tripping the breaker or breakers. The relay is inspected visually and contacts are serviced.

Company No 11—Primary protective relays are on a nominal annual schedule. Relay calibration test schedule in effect is as follows: 220 kv, 66 kv (except pilot wires) and frequency converters—12 months; 33 kv, 13.2 kv and generating stations—12 months; 66 kv pilot wire relays—3 months; 4 kv and 2.4 kv circuits—24 months; 66 kv, 33 kv and 13.2 kv customers—24 months.

Relay exercising or tripping tests are made as follows: 220 kv 66kv and frequency converters—2 months; 33 kv, 13.2 kv, 4 kv and 2.4 kv circuits at attended substations—4 months, unattended substation—3 months; 13.2 kv, 4 kv and generating stations—2 months.

Company No 12—Relays are tested semi-annually. Monthly tripping tests are conducted by operators at important stations where so-called "toy transformers" are provided. Switchboards are wired so the operator can conduct these tests without relay men being present. Such tripping is done in early morning hours.

Semi-annual tests call for an as-found relay test. Pickup is determined and relay is checked for time at 1½, 3, 5, and 10 times pickup. Relay contacts are cleaned and where contacts are sensitive, a pressure scale is used for adjusting them.

This study of relay testing practices of utilities in a single state demonstrates that no uniform standard of test frequency and comprehensiveness prevails among systems generally. Before it is possible to decide whether test frequencies can or should be standardized or the scope of tests expanded or curtailed, more complete records must be kept of conditions found during periodic tests. With such records in hand, showing the number of potential relay circuit failures detected and the operating performance record of relays under fault conditions, it will be possible to determine the best test program.

A Bigger Job For The Advertising Manager

Power companies face two major sales problems, each magnified by the times. To sell their services and to sell themselves, they must make best use of their advertising talent

H. S. METCALFE*
President
Public Utilities Advertising Assn

IF THE PURPOSES of power company advertising are to be accomplished, the advertising manager should be an integral part of company management. He should participate in the shaping of policies. Just as the engineering chief has major responsibility for decisions in his field, and the sales, operating, rate, and other head men have in theirs, so should the advertising manager be recognized in advertising, publicity, sales promotion and public relations.

He should be called into the inner councils of his company on matters of load building, public and government attitudes, and employee morale. It is only by being accepted on this level that he can help management to raise its sights to long-run opportunities and dangers. Unless he is in on the ground floor of policy making, the advertising manager cannot possibly use his resources of talent and skill to fullest advantage.

Present Problems

Today, the power companies of the nation are faced with two challenges. Both involve basic selling, selling on a scale far transcending anything in the past.

The first challenge is to sell a much greater use of service so as to produce a return on the new, multi-billion dollar investment now being made in expansion of electricity supply systems.

The second challenge is to convince the American public and to keep it convinced, that it is better served by business-managed, tax-paying electric companies than by operations at the political mercy of government.

These two sales programs must go on simultaneously and continously and without foreseeable end.

In the field of load building, electric utility managements will, for the most part, be on familiar ground. Perhaps they will have to move along some paths that have scarcely been explored. But they have knowledge of tested and tried sales promotion and advertising techniques.

In meeting this challenge to sell the increasing volume of electric service which will be available, the advertising manager will be called on to use all his talents. His abilities will be needed in developing the aggressive load-building program every company must undertake once ample generating reserves are restored.

The second challenge, the job of selling the business-managed utility enterprise to company employees and to the public, is certainly not a new one either. But the industry has never demonstrated any ability in it, has no large store of tried and tested techniques to draw on for its accomplishment. In these times this two-fold task of employee and public relations has become of paramount urgency both to the industry as a whole and to every individual electric company. Failure in this effort not only means retarded growth; it will be a portent of the decay and death of electric service as a business-managed, tax-paying enterprise.

It's a fair question to ask if management fully realizes that all problems of these two challenges are of primary concern to the utility advertising manager. Why? Because their solutions are possible only by the use of processes of communication. If an advertising manager is worth his salt, he is the specialist in his company in this one important art—the art of communications in all its forms and aspects. Communication implies an interchange of ideas—flow in both directions through open channels.

On the one hand, there is the job of telling, informing, by every known medium. In management's eyes, the advertising manager should be—and generally is—the specialist in this field. He must possess the essential know-how. If he doesn't, he should either secure it or find another job. Communication in this phase is the *tactical* part, the "know-how" phase, of the advertising manager's job.

In addition to this generally accepted function of the advertising manager, there is the receiving aspect of communications. This includes sensing public attitudes, discovering what creates those attitudes, and knowing what to do to meet problems arising out of them. This is the *strategic* part, the "know-what" phase, of the advertising manager's job. Here is where he can effectively counsel management and help in shaping company policies.

Abilities Needed

And here is where the advertising manager's weakness frequently lies. Either he lacks in having the "know-what" or he has been unable to convince management of his ability to interpret public attitudes and devise counter-balancing company strategies. This ability should be as real and as specialized as the sales manager's ability to judge market conditions and suggest sales activities accordingly, or, as the accountant's and engineer's ability to forecast trends and counsel the appropriate steps to be taken.

Management, in the past, has tended to use only the tactical abilities of the advertising manager. It has failed to utilize his strategic abilities.

The advertising manager's abilities have often been enlisted in a hurry

*Advertising Manager, West Penn Power Co, Pittsburgh, Pa.

when defense had to be whipped into shape to counteract moves for public ownership or meet attacks on rates and policies.

But how much stronger and sounder would a company's position be if it relied constantly on the stragic abilities of its advertising manager in solving problems growing out of public attitudes. By so doing it would utilize his skills in forming and molding public opinion, and in winning public support of business-managed operation.

To merit such confidence, the advertising manager must manifest a keen awareness of all of the elements concerned in a utility's over-all public relations program. Further, he must be able to analyze his company's present status as to both policy and activities affecting its relationships with employees, customers, stockholders and communities.

From such an analysis he should be capable of determining where the company's position is strong, where the weak points lie that need bolstering, and where the areas exist in which conflicting policies or overlaping jurisdictions call for sensible coordination.

Similarly, management should be aware of the tremendous selling job it faces in winning back public esteem. If wise, it will welcome the counsel of the advertising manager who has applied his knowledge and experience to a study of this problem. It should recognize the important part that advertising and the advertising manager can play in furnishing management with adequate tools of communication to do the job on a strategic, as well as a tactical, level.

Therefore, to my fellow-practitioners in the field of advertising and public relations, I urge that they increasingly develop mastery of their two functions, tactics and strategy. Leadership in these abilities will find its proper level in the eyes of alert management. And to utility executives I suggest that the talents of their advertising managers should be utilized where their strategic abilities can be most profitably integrated into company policies and programs. This is at the inception of policies and programs and not, as is so often the case, as hurriedly and lately called defenders against attack from outside forces.

What Is Your Motor IQ?

A. D. ROBERTSON
Formerly of
Allis-Chalmers Mfg Co
Tampa, Florida

MOST ALL OF US in the electrical industry believe we know our motors. But do we? One way to find out is to go through the following questions, check off the answers and then compare with those given.

1. Variable torque, multi-speed motors are used to drive fans, centrifugal pumps and similar equipment. How does the hp rating of these motors vary? (a) Directly as speed, (b) as square of speed, (c) as cube of speed.

2. Motor slip is expressed in percent and is calculated by subtracting full load speed from synchronous speed and dividing by: (a) synchronous speed, (b) full load speed, (c) 100.

3. Conduit box and connecting leads may be changed from one side of motor to the other by: (a) removing housing and turning rotor end for end, (b) return motor to manufacturer for reassembling, (c) removing conduit box and mounting on other side.

4. NEMA frame sizes are standard throughout motor industry. First two digits indicate in inches: (a) vertical distance between centerline of shaft and plane of bottom of mounting feet, (b) two times (a), (c) four times (a).

5. The third digit of NEMA frame size designates in inches to the nearest whole number: (a) distance from vertical centerline of motor to centerline of holes in mounting feet, (b) two times (a), (c) four times (a).

6. Efficiency compared with induction motor of same rating is: (a) lower, (b) same, (c) higher.

7. Pulls into step when: (a) load as applied, (b) speed reaches 90 % of synchronous speed, (c) direct current field excitation is applied.

8. Moment of inertia in lb-ft² at motor shaft of driven machine determines: (a) required starting torque, (b) power factor, (c) pull-in torque.

9. Match proper letter and number:

(a) Starting torque and pull-in torque vary—(1) directly with voltage
(b) Pull-out torque varies—(2) directly as frequency
(c) Speed varies—(3) as square of voltage

10. Are not applied where: (a) minimum starting current is required, (b) speed adjustment is required, (c) power factor correction is required.

11. Compared with squirrel-cage motors, power factor is: (a) nearly same, (b) higher, (c) lower.

12. With standard speed control, motor speed can be reduced to: (a) 70%, (b) 50%, (c) 35%.

13. Horsepower output at 50% speed cannot exceed 40% rated hp without increasing: (a) rotor resistance, (b) size of motor, (c) size of shaft.

14. With standard rotor resistance, starting current on first point of control should be: (a) 50% of full load current, (b) 150%, (c) 300%.

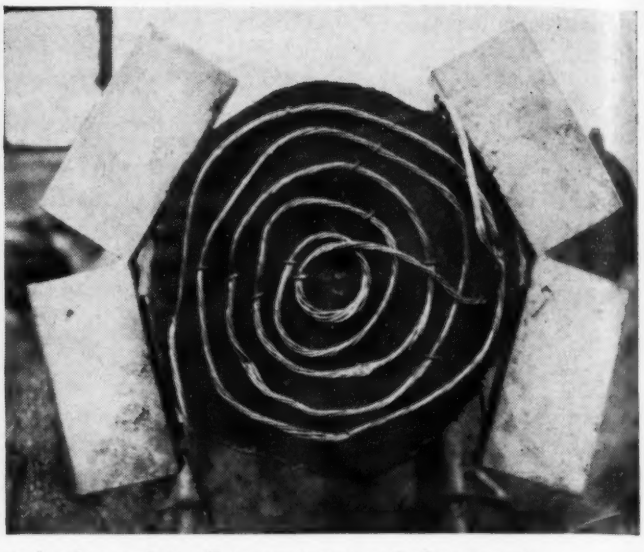
15. Speed of a d-c motor with respect to the armature voltage varies: (a) directly, (b) inversely, (c) is not affected.

16. With constant line voltage, if the field current of a d-c motor is decreased, speed will (a) increase, (b) not change, (c) decrease.

17. High starting torque and severe accelerating duty require: (a) compound wound motor, (b) series wound motor, (c) shunt motor.

Answers

1 (b)	7 (c)	11 (a)
2 (a)	8 (c)	12 (b)
3 (a)	9 (a-3)	13 (b)
4 (c)	(b-1)	14 (b)
5 (a)	(c-2)	15 (a)
6 (c)	10 (c)	16 (a)
	17 (b)	



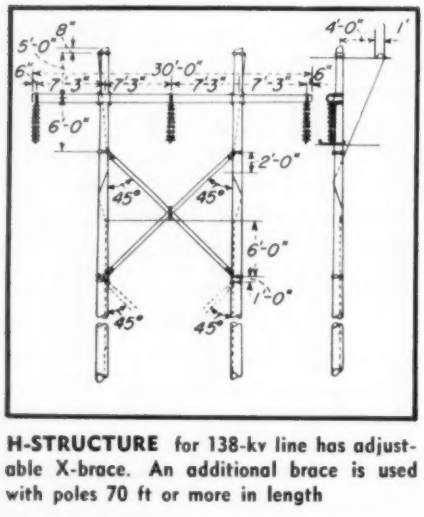
BEARING PLATES attached to base of pole add 200 sq-in of area bearing against soil to counteract vertical movement

Transmission Line Structures Designed To Utilize Full Pole Strength

A. J. BORCHERS
Operating Engineer
and
T. N. COFER
Overhead System Engineer
Central Illinois Public Service Co
Springfield, Ill.

Holes and gains omitted in X-braced H-structure design . . . Bands and clamps reduce decay points and retain full strength of pole . . . Bearing plates restrict vertical movement, and at the same time prevent overturning*

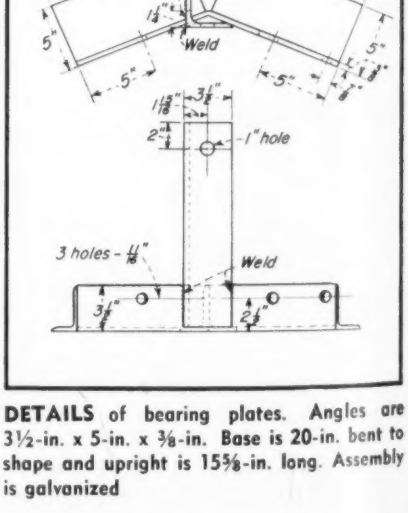
WOOD-POLE H-structure high-voltage lines are now in common use because of the gain possible with wood in series with porcelain in raising the insulation level and reducing flashovers. This type of construction offers improved service and at the same time reduces the cost of transmission line construction. The design now being used for 138-kv lines by Central Illinois Public Service Co incorporates unique features. These have been fully tested for mechanical strength and give promise of offering important advantages in service.



H-STRUCTURE for 138-kv line has adjustable X-brace. An additional brace is used with poles 70 ft or more in length

Bands and clamps are used instead of gains, timber connector rings and bolts for all attachments to the poles or arms above the ground line. They permit the shifting of spar arms and braces and retain full strength of the poles. Elimination of gains, grooves, and holes reduce points of decay. The shattering of wood due to lightning is reduced by avoiding a metallic path to the interior of a pole or arm. The presence of several tight bands acts to restore strength lost due to radial season cracks.

Use of an X-brace on a two-pole structure materially increases the transverse strength (if the top of the X-brace is close enough to the cross arm) and permits longer spans. However, the X-brace connects the poles



DETAILS of bearing plates. Angles are 3½-in. x 5-in. x ⅜-in. Base is 20-in. bent to shape and upright is 15⅝-in. long. Assembly is galvanized

*Adaptation of paper presented at recent Edison Electric Institute, Transmission & Distribution Committee Meeting.

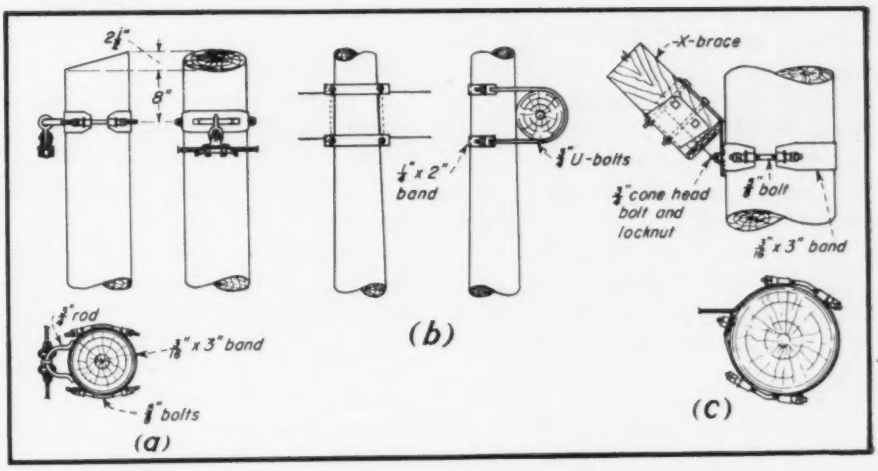
in such a manner that a high velocity wind blowing across the line has the tendency to cause one of the poles to act as a fulcrum and to lift the other pole out of the ground. Foundations for steel towers are designed to counteract this overturning action. But most H-structure wood pole lines now being built are not.

Consideration of several reported incidents of overturning led to the conclusion that a portion of the cost of one storm-guyed structure for longitudinal strength per mile could be used to a better advantage by providing footings on structures distributed throughout the length of the line. This was considered advisable since the conductors and overhead ground wires each have a strength of about 15,000 lb and the possibility of more than one wire breaking in any one location is remote. Therefore, the longitudinal strength of a storm-guyed structure, each mile, is no longer needed.

Bearing Plates

Bearing plates, designed for attachment to the base of the pole, provide an area of 200-sq in. to bear against the soil to counteract vertical movement of the pole in either direction. They are formed in such a way that the two pieces can be attached to the pole before setting, fitting into a 36-in. diameter hole dug by an earth boring machine and without interfering in any way with tamping of the earth around the pole. These bearing plates are also attached to the structure ground wires and, having an area of about 8½ sq ft of grounding surface per pole, materially reduce the ground resistance. This is an important factor in the lightning protection design.

Since the stresses in an H-structure are difficult to calculate where the poles are firmly anchored against overturning and when the structure is deformed by a heavy transverse load, test structures were erected and loaded to destruction. Vertical loads were represented by sand filled barrels, the weight of which correspond to the weight of a 650-ft span of conductor coated with ½-in. layer of ice. The horizontal wind load representing a wind pressure of 4 lb per sq ft was applied by use of winch lines passing through sheaves on a stub pole. Tensions were measured by use of dynamometers. Structure deformation was measured by nailing yard sticks to the poles and taking readings through a transit. The transverse loads exceeded the requirements of the Fifth Edition of the National Electrical Safety Code for Grade B construction in the heavy loading district.

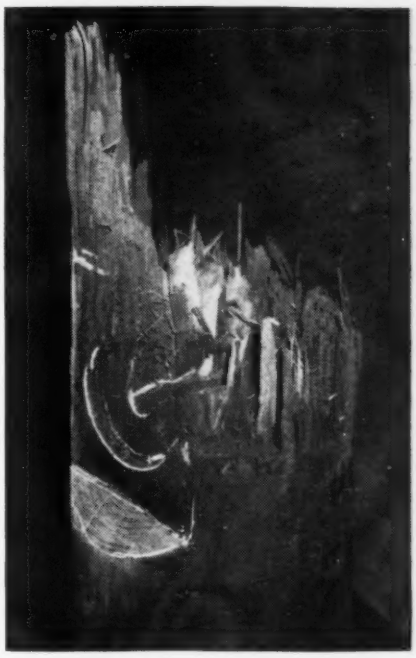


POLE ATTACHMENTS with bands and clamps (a) for overhead ground wire, (b) spar arm attachment, and (c) X-brace attachment

When a load representing a safety factor of six was applied to a 55-ft structure equipped with bearing plates, one pole settled ⅜ in. while the other pole was lifted ⅝ in. This structure failed at a safety factor of about seven when the X-brace, which was in tension, split at each end and pulled loose from the pole at the lower end. This X-brace was 3-in. x 8-in. x 22-ft creosoted pine. It was attached to the poles with 4-in. timber connector rings and ⅞-in. bolts.

When a load representing a safety factor of four was applied to a 75-ft structure also equipped with plates, one pole settled ⅜ in. while the other pole was lifted ⅞ in. This structure failed at a safety factor of about five when the pole in compression broke at the spar arm and at the top and bottom X-brace attachments. Although the breaks appeared to be simultaneous, the moving pictures indicate the first failure to be at the top brace attachment, which confirms the design calculations. This structure was braced with a conventional 3⅜-in. x 5⅜-in. fir X-brace secured to the poles with ⅞-in. bolts.

The safety factors of these two structures are not comparable since the structures are not of the same height. The 55-ft structure failed when the moment about the ground line reached 506,800 lb-ft while the



SPAR ARM broken during construction shows point of weakness due to gain, groove and bolt hole. Strength reduction is 36%

SPAR ARM CLAMP in place

75-ft structure did not fail until this moment reached 520,750 lb-ft. Observations during the second test did indicate that the design could be strengthened and deflection reduced by using an additional brace. Specifications were revised and two braces were installed on structures having poles 70 ft or more in length.

These tests served to prove that bearing plates were ample and effective in preventing the overturn of the structure. It was decided to install bearing plates on alternate structures throughout the length of the line; also, to install them on all telephone and railroad crossing structures and on all structures using poles 70 ft or more in length.

Tests of ground resistance on all structures in the first 80 miles of line constructed show an average resistance of 6.92 ohms for structures without bearing plates and an average of 4.55 ohms for structures with plates —a reduction of 34%.

Ground Wire Support

A search for a satisfactory method of ground wire attachment revealed that most of the devices utilize bolts through the pole in such a manner that the top of the pole might be split in the event of a broken wire. It would therefore be necessary to use "anti-split" bolts and washers or a combination of bolt and pole band to avoid structure damage.

The use of "ridge irons" to support the overhead ground wire above the top of the pole improves the shield angle slightly but has the disadvantage of providing a longer lever arm acting to increase the pole splitting action and making the use of sagging blocks difficult.

It was decided to use a band-type attachment for supporting the ground wires. The band itself is a standard item but requires the use of a special loop welded to the band. A standard figure 8 twisted link is placed on the loop before welding and serves as a flexible attachment for suspension clamp. Two sizes are required to accommodate various pole top diameters of Class No. 1 and No. 2 cedar poles.

One of these bands was installed on a western red cedar pole and a vertical load of 1,000 lb was applied with no measurable deflection—2,000 lbs caused a deflection of $\frac{1}{4}$ in. One 650-ft span of $\frac{3}{8}$-in. overhead ground wire coated with $\frac{1}{2}$-in. layer of ice weighs 580 lb.

The question of "spar" versus "plank" crossarms is debatable. It seems reasonable to believe that timber used in its natural shape is less expensive, resists weathering and retains a greater strength than plank timbers. The top flat surface of sawed timbers, large areas in intimate contact, bolt holes, gains and timber connector ring grooves are all potential sources of decay.

The crossarm selected is a 30-ft creosoted yellow pine pole complying with ASA Pole Specifications except that the small end circumference must be between 25 in. and 31.5 in. and the taper is limited to 1 in. of diam for each 10 ft of length. Although spar arms may be obtained turned to uniform size, the turning cost does not seem justified for the sake of appearance, especially when the process reduces the strength of the arm.

It is possible that the lack of a suitable means of attaching a spar arm to a pole has restricted the use of spar arms. One disadvantage of the through bolt method of crossarm attachment is the possibility of structure fires caused by leakage current. This condition sometimes occurs in that portion of the pole and arm which remains dry during a rain and is the result of concentrated I^2R loss in this small, high-resistance area. Paralleling this dry area with a low-resistance metallic path would eliminate this condition.

The method developed for attaching a spar arm to a pole eliminates gains, avoids loss of pole and arm strength and provides a low-resistance path for leakage currents. The attachment makes use of $\frac{3}{4}$-in. U-bolts and special pole bands. It is anticipated that two sizes of bands and three sizes of U-bolts will be required to accommodate the variation in spar arm and pole diameters. The cost of material for the new attachment method is $1.26 more than the old method for each pole attachment. This is a small price to pay to avoid a strength reduction of 36 percent and to take the risk of pole burning.

Tests of an individual clamp were conducted to determine the strength and slip of this method of attachment for both vertical and transverse loads. The maximum load acts vertically and is 1,770 lb assuming $\frac{1}{2}$-in. layer of ice and 650-ft level ground span, with 350,000-cir mil H. D. bare copper. The test load of 2,000 lb caused the arm to slip $\frac{1}{16}$ in.

X-Bracing and Final Test

The convential brace, as used in the test of the 75-ft structure, avoids mechanical objections to the plank brace, eliminates gains and timber connector rings and reduces the torsion in the poles. When the substitution was made, the attachment was raised 1 ft which reduced the moment arm for the crossarm load from 7 to 6 ft. This was important since the strength of the structure under transverse loading is determined by the strength of the pole at the top X-brace attachment.

Poles are usually purchased with the top brace bolt holes bored by the vendor, and it is necessary to bore the bottom brace bolt holes in the field, adding materially to the cost of assembly. After a structure is assembled on the ground and erected, it is often necessary again to lift the structure and adjust the depth of one of the holes so the structure will stand plumb. It was therefore decided to attach the X-brace to the poles by use of special pole bands.

The tests of the 55-ft and 75-ft structures described above confirmed the effectiveness of the bearing plates in a clay soil and pointed out the structure weaknesses resulting from timber connector rings and gains. In order to test the bearing plates in sand and to check the overhead ground wire band and the spar arm attachment clamp, a similar test was conducted on a 65-ft structure set normal depth in sand of a type which required the use of sand barrels during erection. In order that the structure could be left in the line for further observation and study, the loading was limited to the requirement for Grade B construction in the heavy loading district. Under maximum load one pole settled $1\frac{1}{8}$ in. while the other pole was lifted $2\frac{1}{8}$ in., proving that the bearing plates are also ample when used in sand. At the end of the test, neither the bands nor the spar arm clamps showed any indication of permanent deformation or slippage.

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN

RIGHTING BEGINS as upper end of one transformer is raised about 30 deg by jacking and cribbing. Each transformer is 11 ft wide, 15 ft deep, 19 ft high, weighs 95 tons, has a 50,000 kva base rating

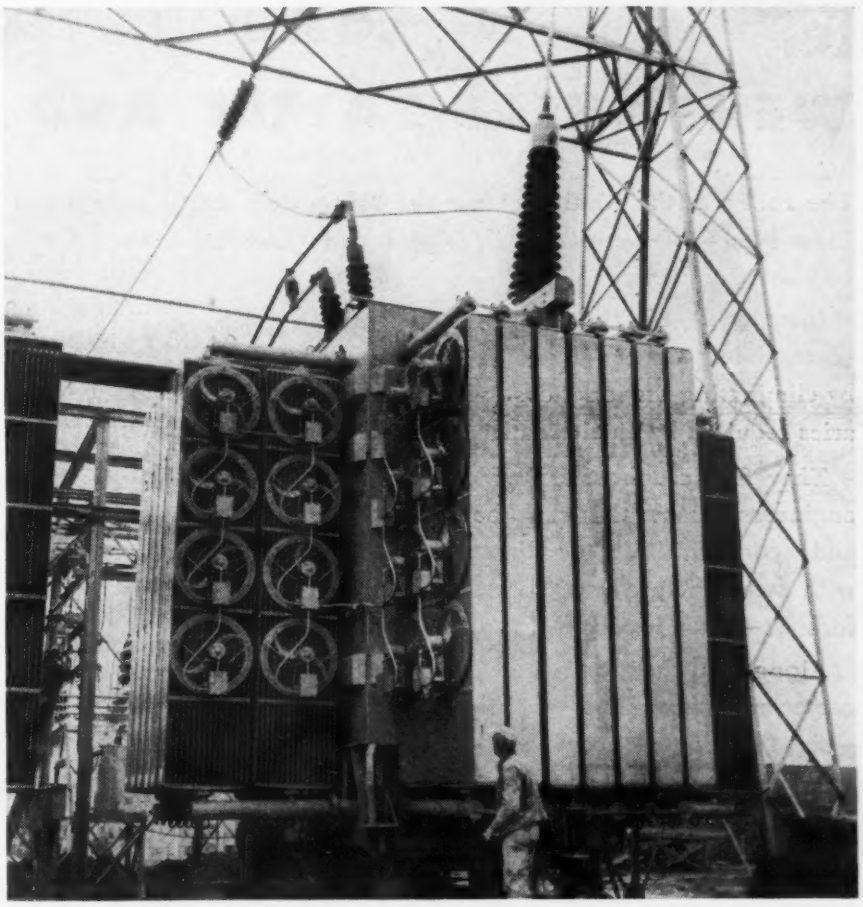
RAISED SLOWLY from cribbing at right, the transformer is being lowered to cribbing at the left. Diesel winches "take up" on cables at left and "slack off" slowly on cables at right

95-Ton Transformers Righted Without Crane

THEY HAD PLANNED to have a 100-ton crane on hand. But it wasn't available. That's how it came about recently that four of the largest-rated single-phase transformers ever shipped to the Pacific Coast were righted from their horizontal shipping position with two diesel winches, block and tackle, jacks and cribbing.

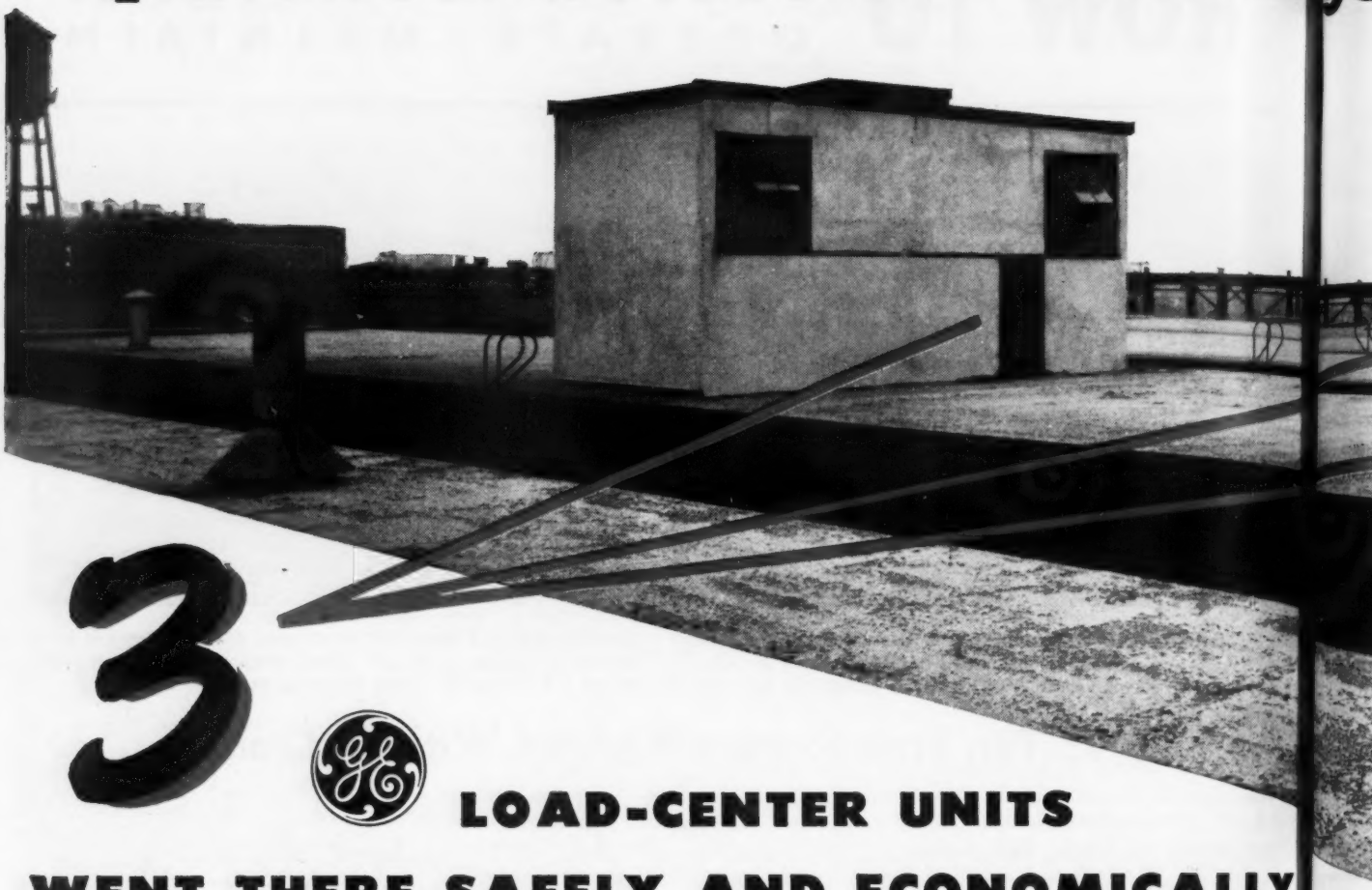
Each of the four transformers was triple rated with a base rating of 50,000 kva with natural cooling; 66,667 kva with fans and 83,333 kva with fans and forced oil cooling. Three of them—one is a spare—make up the first 230/115 kv transformer bank at Snohomish substation of the Bonneville Power Administration near Everett, Washington. They weigh 95 tons apiece.

Westinghouse practice is to ship these triple-rated, shell-form, form-fit transformers on their sides, completely assembled, except for radiators and bushings, and with tap changing under load apparatus connected in place. How these particular units were righted with comparatively light tackle under the direction of Charles DeLapp, chief rigger for BPA is shown dramatically in the accompanying pictures.



READY TO GO the transformer is now connected to the line. It was shipped from the factory completely assembled except for radiators and bushings which were added in field

power substations had to go



3 LOAD-CENTER UNITS WENT THERE SAFELY AND ECONOMICALLY

The roof was the ideal spot for the substations at Plant No. 6 of the Campbell, Wyant and Cannon Foundry Company.

Installed there, these three 1000-kva G-E load-center units paid top dividends right from the start—by eliminating the long, costly heavy-copper secondaries required by an alternative method.

They first caught the practical eye of the plant engineers because they *could* be installed there, safely and economically. Co-ordinated unit substations—with metal-enclosed switchgear and Pyranol Transformers—made it possible.

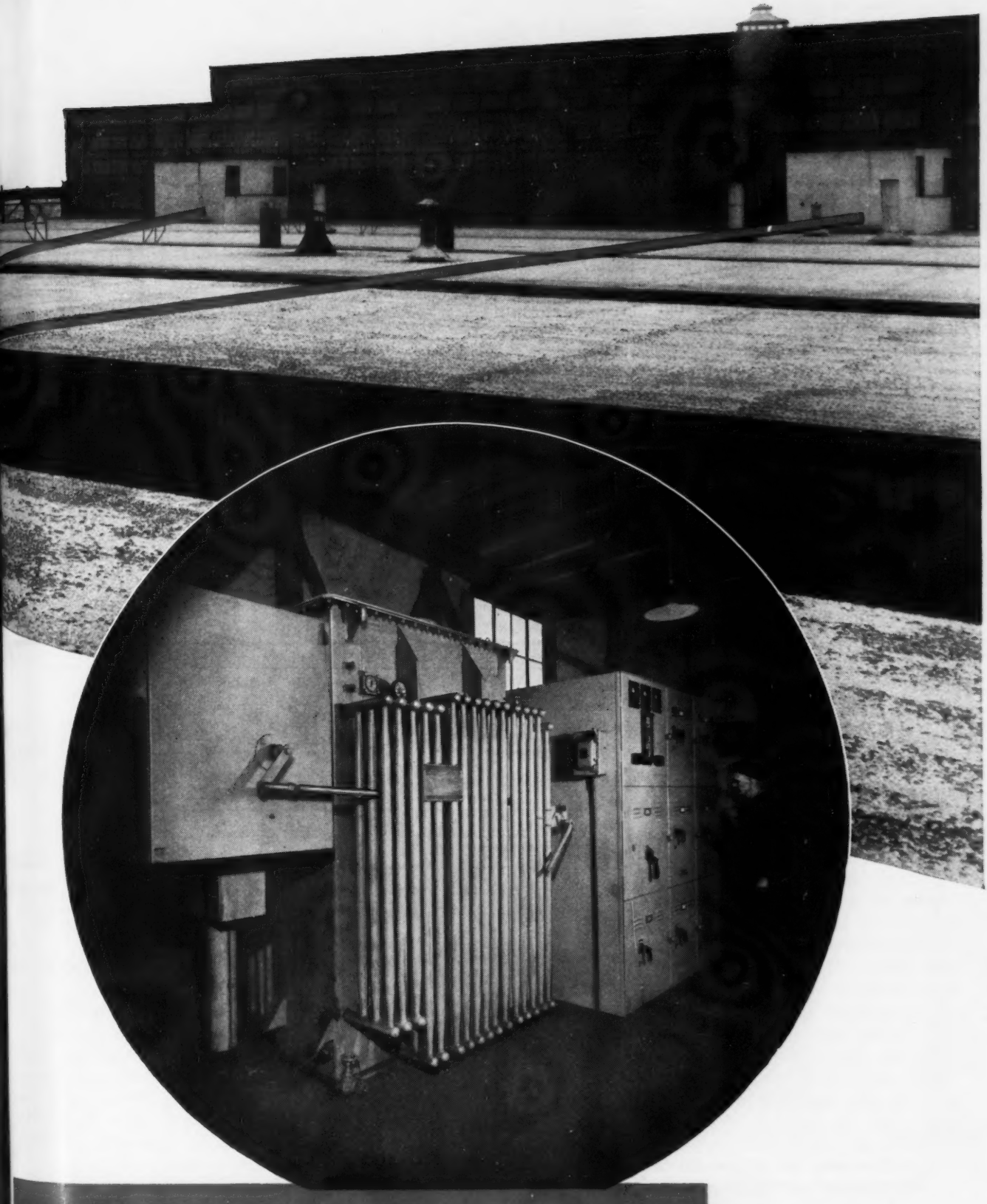
Along with these three units, two other G-E load-center unit substations—a 750- and a 1000-kva unit—went in Plants 1 and 3, replacing outgrown open-type equipment of inadequate interrupting capacity. The Electrical Superintendent reports that all the new units have been easy and economical to install, operate and maintain. Most of all, he values the increased protection they afford, both to personnel and to continuous plant production.

"You can haul them in, hook them up and you are ready to start," he says. "Then you can forget about them. Our confidence in these unit substations has been substantiated by their record on the job."

In fact, a modernization program at the Campbell, Wyant and Cannon Company calls for all obsolete distribution equipment to be replaced with modern unit substations of increased capacity.

Your G-E sales representative will be glad to work with you on your next plant distribution problem. His recommendations will be based on General Electric experience with thousands of load-center distribution systems. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

go on the ROOF!



GENERAL ELECTRIC

321-49

Damaged Transformer Carries Unbelievable Load

N. J. GALUPPO
Transformer Repair Supervisor
Indianapolis Power & Light Co
Indianapolis, Ind.

A TRANSFORMER with part of its primary and secondary windings shorted out continued to serve a customer and carry full load. This occurred on our system under the following circumstances. On Sunday, January 11, 1948, a 4-kv lightning arrester failed when a bank of 500-kva capacitors was energized at a steel rolling mill.

A No. 2/0 lead from the main 4-kv bus to the lightning arrester fell across that bus, creating a 3-phase fault. This damaged twelve 4-kv pin-type insulators, 15 ft of 1-in. copper tubing and the fuse clips on the 33-kv, 200-amp S. & C. liquid fuses. Four hours later repairs were completed and the substation was in normal operation.

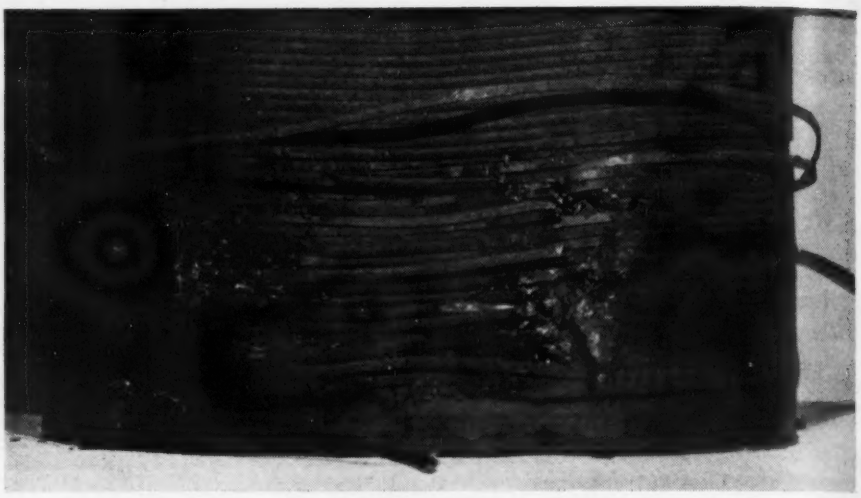
Transformer Bank

The bank consisted of three 667-kva transformers connected delta on the 33-kv side and wye on the 4-kv side. During the failure 3-phase fault currents were calculated to be 37,100 kva on the 4-kv bus. This bank feeds the rolling mill and a 4-kv circuit supplying domestic load.

The next day, (Monday), a number of low voltage complaints were received. Voltage measurements on the two 33-kv lines feeding this bank checked satisfactorily. Voltage measurements on the 4-kv side revealed a 10% unbalance on the east transformer phase. During the week, the unbalancing increased to 14%. All evidence pointed to trouble in the east transformer. However, the only external evidence of that was from the oil temperature gage. It registered 10 C higher than the gages for the other two transformers.

The steel mill was working around the clock and would not permit shutdown until the weekend. Meanwhile the bank carried approximately full load continuously. Oil samples drawn from transformer revealed no burned odors as generally accompanies a transformer that has had an internal fault. Our mobile 33/4-kv substation was connected for stand-by service only, and could be connected, in case of total failure, in a matter of minutes.

Saturday of that same week the bank was taken out of service. Oil drained out of the east transformer revealed smoke curling upward out of the vertical ducts in the low-voltage winding. Upon dismantling, two turns were found shorted out but not open in the high-voltage winding, and approximately 13 turns burned and shorted out in the low-voltage winding, as shown in the accompanying photograph.



SECTION OF A 667-KVA transformer secondary coil has 13 turns of four-strand (0.82 x 0.260) copper burned and shorted out. The transformer continued to serve a steel plant for seven consecutive days. Not shown, but another reason the unit should have failed, were two turns in the primary which were shorted out but not open

VOLTAGE CHART (0.15 power factor load) shows how regulating circuit in 360-cycle generator operates to raise the voltage, thus helping to compensate line voltage drop

Voltage Regulated For High-Frequency Tools

R. L. GOMON
District Manager
Electric Machinery Mfg Co
Detroit, Mich.

VOLTAGE FOR high-speed a-c electric tools can be regulated by a high-frequency (180 and 360-cycle) generator set with a built-in automatic circuit designed for that purpose. The circuit was described in EW, Apr 24, 1948, p. 90.

With the application of the high-frequency generator set there is provided in the generator itself not only the automatic voltage regulation to keep the generator voltage steady, but also automatic compensation for line voltage drop. The complete voltage regulation provides the optimum condition for operation of electric tools.

In the operation of high-frequency electric tools, such as are used extensively in the automobile industry for grinding, buffing, body polishing, drilling, screw driving and nut running, high torque must be available

0,000, 15,000, even 25,000 lumens.

For this high-level lighting, both incandescent and mercury have advantages: The much lower lamp cost and the lower investment for incandescent systems *may* outweigh the high efficiency of mercury. The conventional color may be preferable.

But—in the higher levels and special applications, new light sources do definitely compete, and in these you should always make individual comparisons.

East Erie Ave., Lorain, Ohio. G-E Form 79R luminaires with 6000-lumen incandescent lamps.

turn-offs to a tunnel, bridge or express route. And finally, bridges and highways in general—but *only* after a comparison of operating costs.

Sodium lamps have an efficiency 2¾ times that of incandescent. Their 4000 hour life (8000 on continuous burning) cuts servicing costs, makes annual lamp cost on a par with incandescents.

So—sodium lighting, where it can be used, is tops.

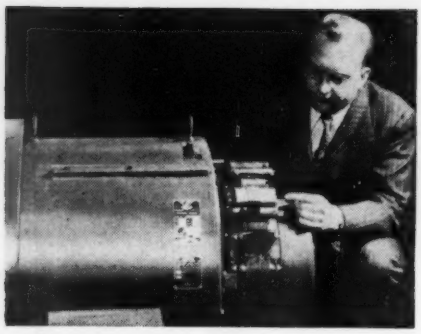
G-E sodium-vapor luminaires on the Charter Oak Bridge, Hartford, Conn.

crisp blue-green—makes it especially appropriate for white ways. When vertically burned lamps are used, many modern incandescent-type luminaires, with proper ballasts, give maximum utilization efficiency, and maximum visibility. Mercury's one disadvantage is high lamp cost, which is partially overcome by long lamp life.

Summing up: Mercury must usually be "proved in"—but, more often than not, will prove economical for higher intensity installations.

Looking west on First Ave., Spokane, Wash. G-E Form 101D luminaires with 16,000-lumen mercury lamps.

GENERAL ELECTRIC



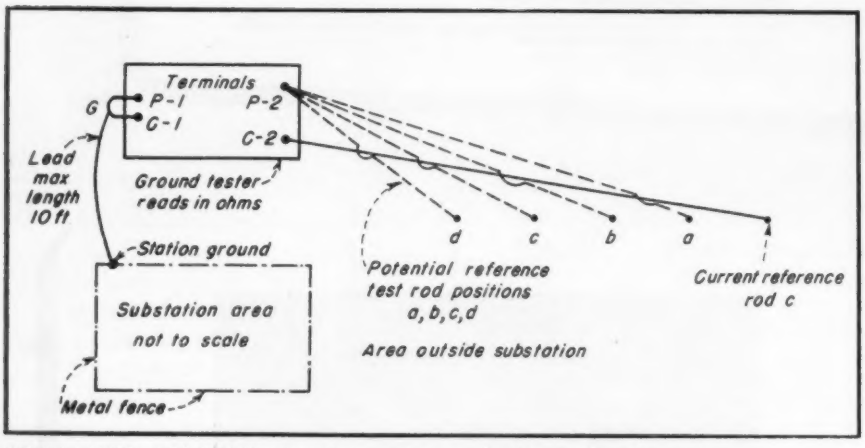
VOLTAGE REGULATING circuit components mounted on saddle over exciter

to maintain tool performance for maximum production. Because high-frequency tools use miniature, 3-phase, squirrel-cage induction motors in which the torque varies as the square of the voltage, well-regulated voltage of the proper, rated value is essential. At undervoltage, the motor torque and speed fall off rapidly so that the electric tool cannot perform as it should.

The generator compensates for low power factor. Due to relatively low load factor, high-frequency electric tool circuits operate at low power factor, usually in the range of 0.35 to 0.6. That means that the generator and the distribution lines must deliver two to three times as much current as actually required for the power (kilowatt) output of the tools. Also, the characteristics of high-frequency current are such that the distribution lines themselves contribute to the lowering of power factor. Under such conditions the voltage drops off in the distribution lines, and is not compensated for by the usual generator even with a voltage regulator because voltage is controlled at the generator terminals only. Voltage drop in the line is particularly pronounced when load power factor equals line power factor. On 360-cycle service and at 0.5 power factor this situation exists with wire sizes around No. 1 and larger. Line voltage drop due to low power factor is automatically compensated for by generator. The generator is inherently over-compounded at lagging power factor loads. When a lagging load is thrown on, the tendency for voltage to drop is at least partially compensated. This is shown in the accompanying chart (from 240 to 248 v.)

A high-frequency generating set using the built-in regulating circuit is illustrated. Induction motor drive is generally used on 18, 25 and 31 kva, 1800 rpm, 180 and 360 cycle sets, but with 63 kva sets and larger the efficiency and power factor corrective advantages of a synchronous motor often makes it a favored drive. Present tendency in the automobile industry is toward use of the smaller sets placed individually near to load areas. By using two generator sets, and distributing through a panel board with double-throw switches, the load can be put on one set or both, thereby giving reserve capacity.

How To Make Earth Resistance Tests At Substations



SCHEMATIC DIAGRAM of testing routine to check ground resistances

PROCEDURE IN EARTH resistance testing by an eastern utility makes use of a Biddle Megger ground tester. It is assumed that the substation ground set-up is not connected to a municipal water system and that the test is inapplicable to an isolated or small water system. All substation metal fences are connected to the station ground system. Hence the entire area inclosed by the fence becomes the ground to be tested. All tests are made beyond the fence enclosure.

Normally tests are not conducted in wet weather or in the vicinity of an electric storm. Rubber gloves are used when making electrical connections to test rods and to the instrument when cranking.

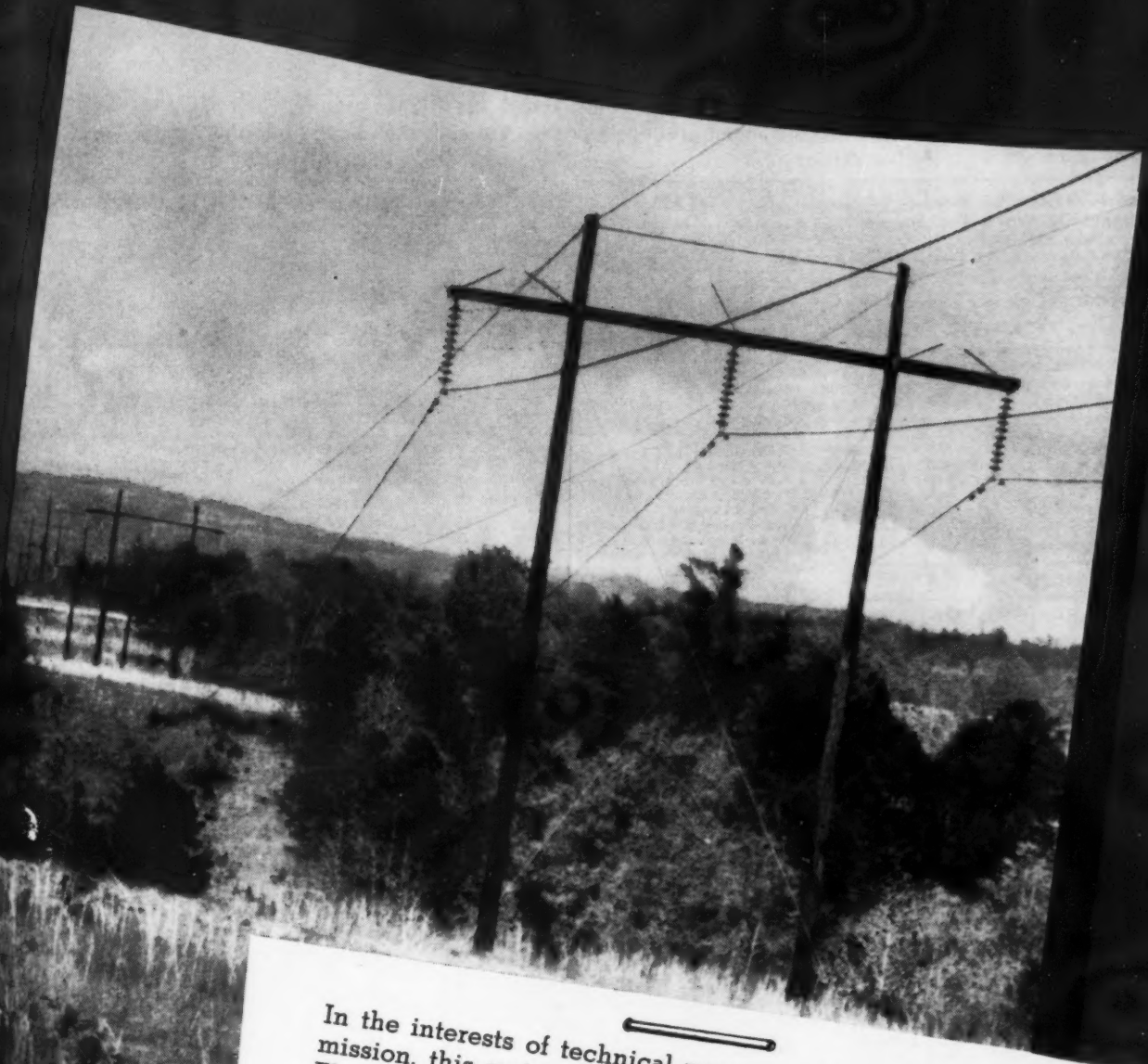
(1) Link the P-1 and C-1 terminals (G) together on the instrument. Connect by a short lead to the fence ground connection. Lead not over 10 ft long, so that its resistance will be inappreciable.

(2) The current reference rod should be driven at least 3 ft in the earth. Connect it to the C-2 terminal of the instrument. The distance this rod is to be driven from the fenced inclosure will depend on the size of the area. In general this should be about five times the greatest diagonal length of the fence inclosure plus 100 ft, but not less than 200 ft or over 1,000 ft.

(3) The potential reference rod should be connected to the instrument's P-2(P) terminal. Drive the rod at least 3 ft into ground at intervals between the station and the C-2(C) rod, starting at 40% of the distance from the fence to the C rod and ending at 90% of the distance. The intervals are to be 10% of the distance between the fence and the C-2(C) rod. Care must be taken to drive the rod true without vibration, thereby minimizing contact resistance between the rod and the earth.

(4) Instrument readings to be taken at the above test distances. If at least three consecutive readings are approximately equal, the test may be considered complete. If there are less than three equal readings, move the test rod further out and repeat. Consult headquarters beyond 1,000 ft. Yearly checks are to be made.

to hamper fine lightning Company's 182-mile, 110-kv line



In the interests of technical progress of high-voltage transmission, this series of operating reports is presented to the Electrical Industry. As a manufacturer of insulators and hardware, the Ohio Brass Company is vitally concerned in this development. These reports and many others will soon be compiled in book form and made available to power company engineers.

2853-H

Ohio Brass

MANSFIELD, OHIO

Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Lighting Recommendations For Sports And Recreational Areas

DANA W. ROWTON, Manager, Lighting Application Engineering, Westinghouse Electric Corp, Cleveland, Ohio

Tables provide (1) a listing of new proposed numbers of floodlights required and NEMA-1936 Standard, and (2) current recommended practice for illumination based on IES Lighting Handbook

TABLE I — Required Number Of Floodlights Or Watts Per Square Foot Of Surface

SPORT		Number of Floodlights NEMA-1936	NEW-Proposed
ARCHERY RANGE (per target)		1	1
BADMINTON COURT		4	4
BASEBALL			
Major League		750	1000
AAA and AA		400	500
A and B		240	320
C and D		160	240
Semi-Pro and Municipal		120	160
BASKETBALL (outdoor)		8	8–12
BOWLING GREEN		22	16–44
BOXING AND WRESTLING RING		8–20	8–24
CROQUET		4	4
FOOTBALL			
Class A	old classifications	120–144	.....
Class B	old classifications	80–108	.....
Class C	old classifications	60–84	.....
Minimum	old classifications	40–54	.....
I	new classifications	.....	450–480
II	new classifications	.....	200–216
III	new classifications	.....	120
IV	new classifications	.....	100–180
V	new classifications	.....	50–90
GOLF DRIVING RANGE (per 50 ft width)		6	6
HORSESHOE COURTS		2–4	2–8
HOCKEY RINK		20	20–56
SKATING AREAS (Outdoor)		0.25 w/sq ft	0.2–1.0 w/sq ft
SKI SLOPE		0.03 w/sq ft	0.03–0.1 w/sq ft
SOCCER FOOTBALL		60–108	50–252
SWIMMING POOL—UNDERWATER		1.5–5.0 w/sq ft	1.5–5.0 w/sq ft
SWIMMING POOL—OVERHEAD		0.5–1.25 w/sq ft	1.4 w/sq ft
SOFTBALL			
Class A	old classifications	24–48	.....
Class B	old classifications	18–34	.....
Class C	old classifications	12–14	.....
Professional and championship	new classifications	.....	120–280
Semi-Pro	new classifications	.....	84–180
Industrial League	new classifications	.....	32–96
Recreational	new classifications	.....	16–28
TENNIS COURTS			
Single Court Layout		8–12	8–40
Double Court Layout		8–12	12–48
TRAP SHOOTING		8	8
VOLLEY BALL (Playground)		4	4–6

TABLE II—Current Recommended Illumination In Footcandles

SPORT	Average Horizontal Ft-c in Service	
	Vertical on Target	Shooting Line
ARCHERY		
Tournament	10	10
Recreational	5	5
BADMINTON		
Tournament		30
Club		20
Recreational		10
BASEBALL	Infield	Outfield
Major League	150	100
AA and AAA League	75	50
A and B League	50	30
C and D League	30	20
Semi-Pro and Municipal League	20	15
On seats during game	—	2
On seats before and after game	—	5
BASKETBALL		
College and Professional		50
High School		30
Recreational		10
BATHING BEACHE	On Land	In Surf
	1	1
BILLIARDS (On Table)		
Tournament		50
Recreational		30
General Area		10
BOWLING	General	On the Pins
Tournament	20	50
Recreational	10	30
BOWLING ON THE GREEN		
Tournament		10
Recreational		5
BOXING OR WRESTLING (Ring)		
Championship		500
Professional		200
Amateur		100
Seats during bout		2
Seats before and after bout		5
CROQUET		
Tournament		10
Recreational		5
CURLING	Tees	Rink
Tournament	20	10
Recreational	10	5
FOOTBALL		
Class Index — Distance from nearest side line to the farthest row of spectators.		
I — Over 100 ft		100
II — 50 to 100 ft		50
III — 30 to 50 ft		30
IV — Under 30 ft		20
V — No fixed seating facilities		10
GOLF DRIVING		
General on the Tees		10
On Vertical Surface at 200 yd		3
Practice Putting Green		10
GYMNASIUMS		
Exhibitions and Matches		30
General Exercising		20
Lockers and Shower Rooms		10
HANDBALL		
Tournament		30
Club		20
Recreational		10

SPORT	Average Horizontal Ft-c in Service
HOCKEY	
College or Professional	50
Amateur	20
Recreational	10
HORSE SHOES	
Tournament	10
Recreational	5
RACING	
Bicycle	20
Motor (Midget Auto or Motor Cycle)	20
Horse	20
Dog	20
RIFLE RANGE	Outdoor / Indoor
On Target	30 / 50
Firing Point	10 / 10
Range	5
ROQUE	
Tournament	20
Recreational	10
SHUFFLE BOARD	
Tournament	10
Recreational	5
SKATING	
Rink	5
Park, Lagoon, or Pond	1
SKEET SHOOT	
Target—Vertical Surface at 100 ft	30
Firing Point—General	10
SKI SLOPE PRACTICE	5
SOCCER	
Professional & College	30
High School	20
Athletic Field	10
SOFTBALL	Infield / Outfield
Professional and Championship	50 / 30
Semi-Pro	30 / 20
Industrial League	20 / 10
Recreational	10 / 5
SQUASH	
Tournament	30
Club	20
Recreational	10
SWIMMING POOLS	
General	10
Underwater, w/sq ft of surface	
Outdoors	3
Indoors	5
TENNIS	Lawn / Table
Tournament	30 / 50
Club	20 / 30
Recreational	10 / 20
TRAP SHOOT	
Target—Vertical Surface at 150 ft	30
Firing Point—General	10
VOLLEY BALL	
Tournament	20
Recreational	10

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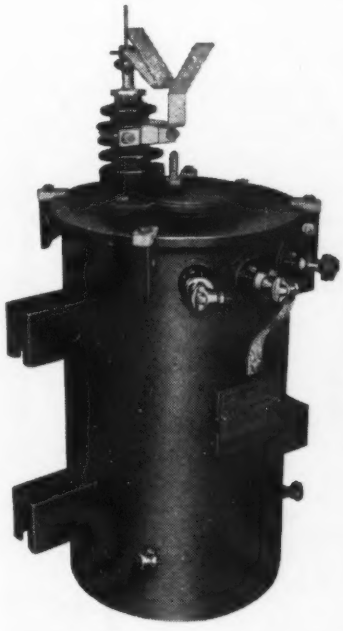
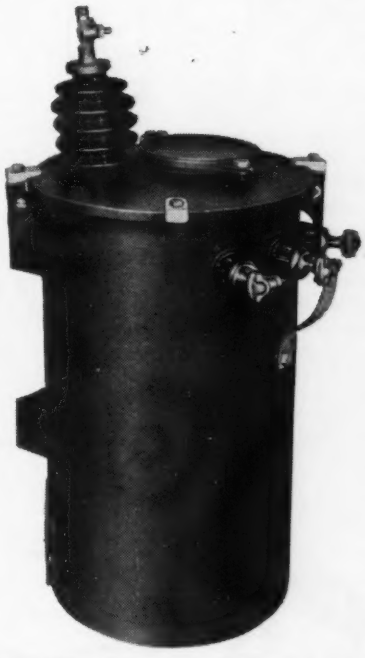
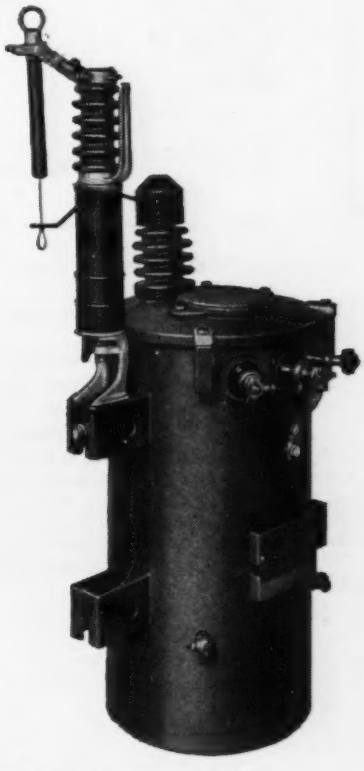


Type HEF-5— Double "bird-proof" gap provides surge protection; internal fuse forms a protective link between the transformer and the high-voltage line. When the double gap and internal fuse are combined no other surge protection or transformer fuses are required.



Type HEF— Standard Rural-Line Transformer, E. E. I.-NEMA specifications.



Type HEF-7— Protected Rural-Line Transformer. Equipped with expulsion-type lightning arrester and primary fuse.

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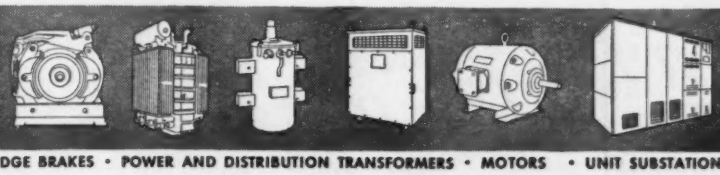

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Selection Of Hydraulic Turbine For Given Head And Capacity

Chart determines: (1) horsepower for given head (H) and capacity (Q); (2) specific speed (N_s) indicative of type of turbine for desired rotational speed, by a line at 90 deg to H-Q line. An efficiency of 83% has been assumed for designing the chart. Use of chart is indicated by dash diagonal lines

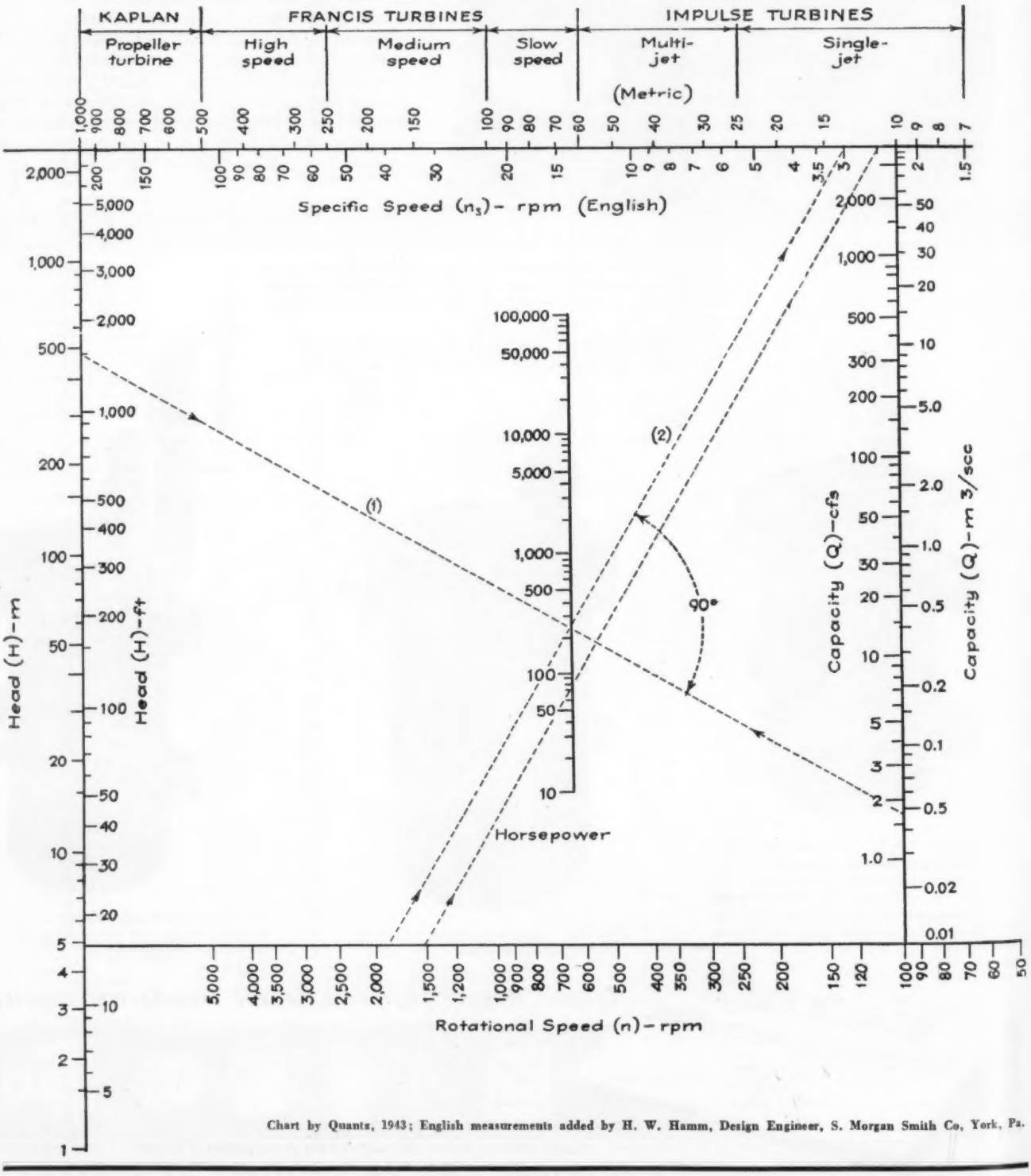
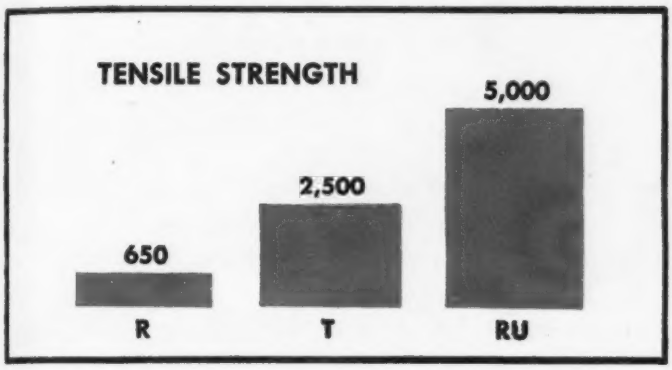
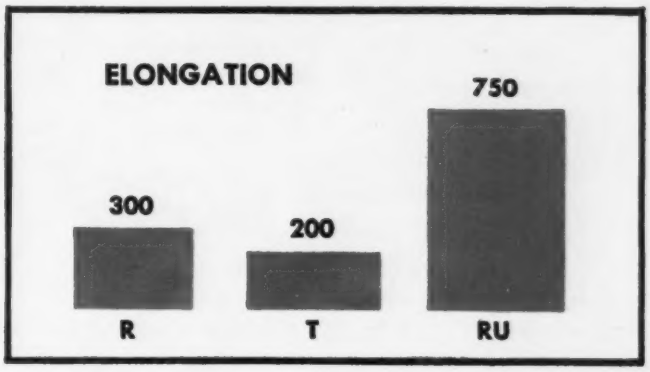


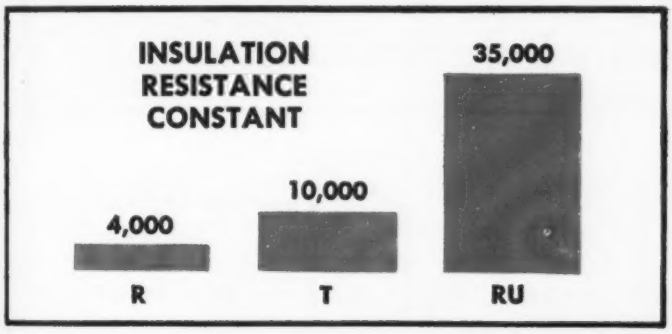
Chart by Quantz, 1943; English measurements added by H. W. Hamm, Design Engineer, S. Morgan Smith Co, York, Pa.

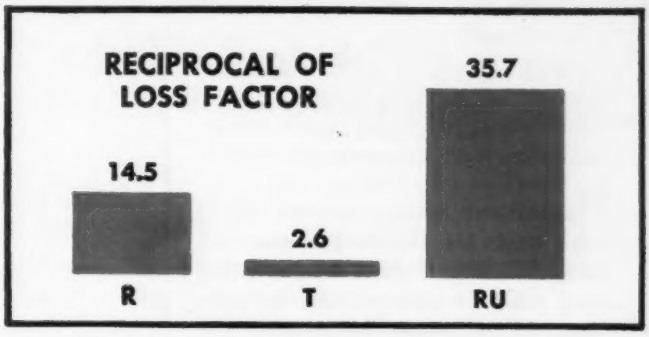
SMALLER DIAMETER CONTROL CABLES INSULATED WITH *Laytex**

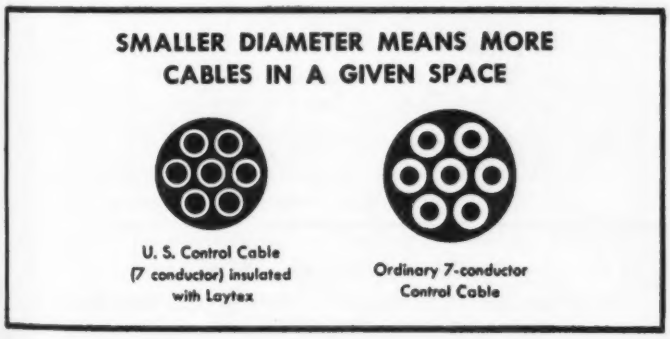
COMPARE *Laytex* ELECTRICALLY AND PHYSICALLY










SMALLER DIAMETER MEANS MORE CABLES IN A GIVEN SPACE
U. S. Control Cable (7 conductor) insulated with Laytex
Ordinary 7-conductor Control Cable

Three common types of insulation used on the conductors of control cable are:

Type R—The copper conductor has a code rubber insulation.

Type T—A copper conductor with thermoplastic (a synthetic compound) insulation.

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The charts above show the wide margin by which LAYTEX leads in physical and electrical qualities. It is one reason why U. S. Control Cables will continue, as in the past 16 years, to provide the finest service obtainable. For more information, write Wire and Cable Department, United States Rubber Company, 1230 Avenue of the Americas, New York 20, N. Y.

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STORAGE RACKS FOR POLES were built of used street car rails that were subsequently mounted on concrete piers

Storage Racks Simplify Pole Handling

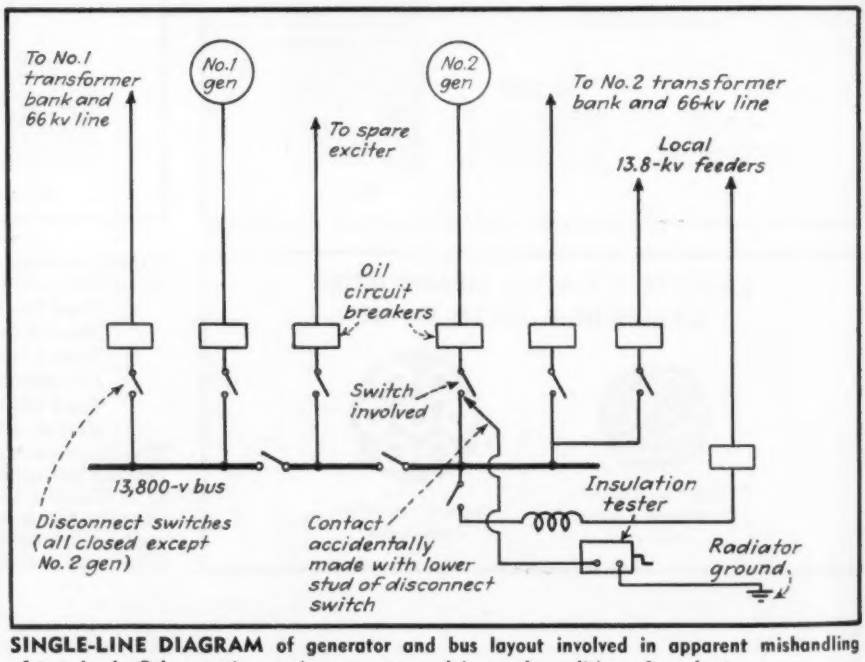
CARL L. RICHEY
Asst to General Mgr
Sacramento (Calif.) Municipal Utility District

PERMANENT POLE storage racks were built for the Sacramento Municipal Utility District by mounting used streetcar rails on concrete piers about 18 in. above the ground. The rails were obtained at $18 per ton. The ground was poisoned to inhibit the growth of weeds and grass.

The racks are built to permit pole storage at a 90-deg angle to the railroad tracks. That arrangement was adopted in part because of the space available between the tracks and the property line. Also, because analysis of loading and unloading problems indicated that in general a more efficient use of yard area would be obtained, and a lesser amount of movement of the crane would be required than if poles were stored parallel to the track.

Under that method of operation, there might, in some cases, be a greater horizontal travel of the boom. But it seemed clear that this would take less time and less frequent moving of the entire crane when considering both unloading from cars and the subsequent loading on dollies.

The poles are arranged in individual bays or piles for each length with access runways between. The layout is quite satisfactory and provides an intangible incentive for efficient workmanship.


To No.1 transformer bank and 66 kv line
No.1 gen
No.2 gen
To spare exciter
To No.2 transformer bank and 66-kv line
Local 13.8-kv feeders
Oil circuit breakers
Switch involved
13,800-v bus
Insulation tester
Disconnect switches (all closed except No. 2 gen)
Contact accidentally made with lower stud of disconnect switch
Radiator ground

SINGLE-LINE DIAGRAM of generator and bus layout involved in apparent mishandling of test lead. Other station equipment appeared in good condition after short

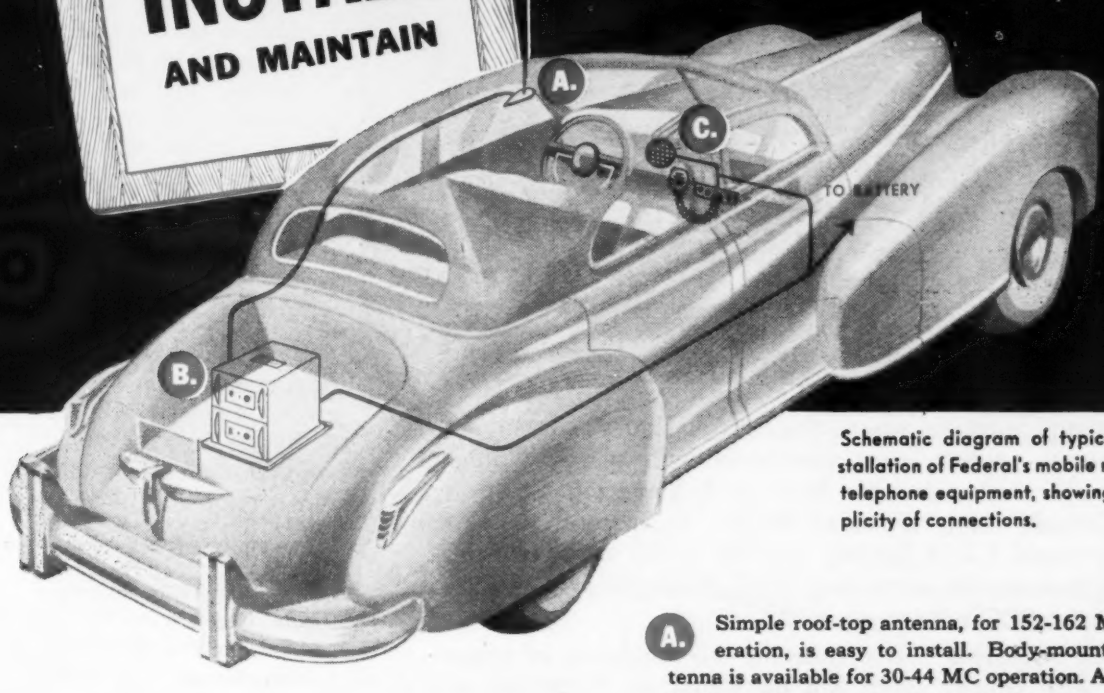
For Safer Testing Of Generator Leads

A FATAL ACCIDENT in a 30,000-kva steam plant occurred in testing insulation of leads on a 13.8-kv turbogenerator. Generated energy is delivered to a 13.8-kv bus. Two local feeders are served from this bus which supplies two outdoor transformer banks tying the plant into a 66-kv transmission system. The test was being made by two young inspectors. Both inspectors lost their lives, and for this reason the precise sequence of test steps taken is uncertain. At the same time, the subsequent engineering investigation indicated lack of caution in undertaking this test and pointed warnings of operating significance. Both inspectors were graduate engineers but had very little experience on this type of job.

Referring to the wiring diagram and acccording to the report from which these notes were taken, No. 1 generator was running at the time.

EASIER TO INSTALL AND MAINTAIN

Federal's Mobile 2-Way FM Radiotelephone offers time-saving simplicity of installation, maintenance and inspection



Schematic diagram of typical installation of Federal's mobile radiotelephone equipment, showing simplicity of connections.

The outstanding FUNCTIONAL DESIGN of Federal's mobile radiotelephone equipment means time and money saved — from initial installation to routine inspection and maintenance.

This equipment has been especially designed to meet the severe service requirements for *all types* of fleet operations — from taxis and police cars, to fire departments, bus lines, Utility repair services, and truck fleets. Its sturdy mechanical construction, simplicity of installation and maintenance, and exceptional *performance* make Federal the first choice of fleet operators who insist on getting the maximum return on their investment.

A. Simple roof-top antenna, for 152-162 MC operation, is easy to install. Body-mounted antenna is available for 30-44 MC operation. Antenna lead requires only *one* connection to the combined transmitter-receiver unit.

B. Compact transmitter - receiver unit is completely wired internally—requires no external connections between sections. Antenna, power, and control connections are at the rear — keeps wiring out of the way—prevents accidental damage. Transmitter and receiver sections have automatic plug-in connectors — units can be removed and replaced in a few seconds.

C. Simple dash-board control unit is connected for operation by plugging in the *single cable harness* which comes already wired to the transmitter-receiver unit. Eliminates the usual maze of connecting cables which are possible sources of trouble.

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KEEPING FEDERAL YEARS AHEAD... is IT&T's world-wide research and engineering organization, of which the Federal Telecommunication Laboratories, Nutley, N. J., is a unit.

Briggs Stadium, where the Detroit Tigers cavort when at home, recently was equipped with a new lighting system, installed by the Brooker Engineering Company of Detroit, using General Electric Equipment. Its eight towers and 1,458 lighting units of 2,750 watts will provide illumination, according to G. E. Engineers, equal to that of 6,000 full moons.

For insulating and protecting the hundreds of important wire splices which will be subjected to all the extremes of a versatile climate—rain, snow, hot sunshine in summer and sub-zero weather in winter—the contractor chose No. 33 "SCOTCH" Electrical Tape with Vinyl Plastic backing. The choice was dictated by the ability of No. 33 "SCOTCH" Electrical Tape to stand outdoor conditions, and its long aging life. Most of the electrical installation work at the Briggs Stadium was carried on in cold weather. When the above picture was taken it was five below zero in Detroit, but the No. 33 "SCOTCH" Tape retained its pliability in spite of the low temperature.

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No. 2 unit was shut down. The operator removed the cover from each No. 2 generator disconnect switch compartment, showing the test men that the switches were open. The ground disconnecting switch on No. 2 generator was opened. The inspectors asked another operator to put the insulation tester ground lead on a nearby radiator. The other instrument lead in one of the inspectors' hands was then evidently brought in contact with the live 13.8-kv stud of the disconnected switch of one phase from Generator No. 2. Since the insulation tester already had one connection on the radiator to establish a ground, the arc flashed to this ground. The leads were completely destroyed and the instrument burned. Hot gases and ionized copper came from the switch compartment. The arc persisted from between 2,400 to 2,700 cycles. Generating unit No. 1 was manually shut down by the alert operator. The low side of the transformer banks tripped out from ground relay operation. These banks were also protected by differential relays. The local 13.8-kv feeders were out 9 min, when service at the plant was restored.

Inspectors Were Warned

The test men had been warned that the lower studs of the disconnect blades in the cells were alive. Whether they became confused or were in haste to finish the test and return home for the weekend is unknown. How the test lead came in contact with the live stud does not appear. The evidence was that all three of the phase blades on No. 2 generator disconnects were not at all free-swinging, but operated stiffly.

The plant power owner uses automobile ignition wire for testing instrument leads, which will withstand 30 kv. If such a wire falls against a live terminal, there will be no flash or contact unless the clip on the end of the lead happens to contact the live terminal. It is not known what kind of wire was used in the inspectors' instrument leads. The possibility exists that the instrument lead was clipped on the switch blade and then fell upon the live stud. This blade was about 4 in. above the stud when open. The blade was about 6 in. long and protruded in front of the stud, and might be reached without going back into the cell as far as the stud. The copper on the blade was smooth

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Using the "Model 38" and a two-man crew, they anchored ¼-inch steel cross plates directly to the concrete flooring with standard drive pins.

The company estimates that they saved *75 per cent* in time over conventional methods—and did the job for *half* the usual cost.

This is only one of many dramatic examples where TEMPOTOOL is saving time and money for users *every day*. For fast fastening—investigate TEMPOTOOL!

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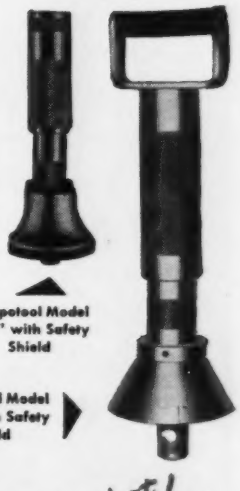

Tempotool Model "22" with Safety Shield

Tempotool Model "38" with Safety Shield

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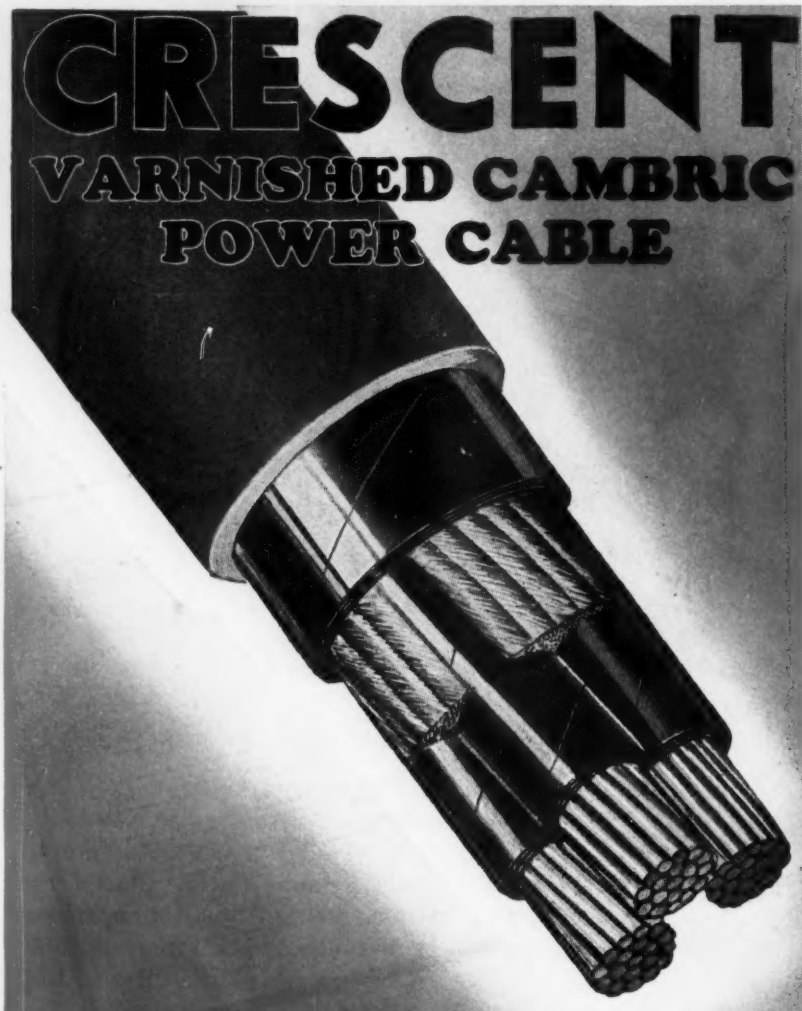

Heavier loads for longer periods of time are possible with CRESCENT VARNISHED CAMBRIC CABLE. This general purpose, industrial power cable provides higher current-carrying capacity for the same size of copper conductors, together with maximum safety and permanence.

Available with weatherproof braid cover for dry locations, with a lead sheath for wet locations, or with a steel tape parkway armor construction (Type VCLJF) for burial in the earth without additional protection.

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WIRE & CABLE

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TRENTON, N. J.

and the type of clip terminal used would not penetrate or grip the blade with much pressure.

A major lesson from this accident was an indication of the preferred method of making such a test. This is to check the disconnect switches to make sure that they are open, and then to replace the barrier in front of them. The barriers on the oil circuit breakers in the non-running generator leads between the generator and the bus would then be removed. The test lead would then be placed on a copper strap of the oil switch assembly which would give a contact with continuity back to the generator through the generator lead. The open disconnects between the circuit breaker and the bus would safeguard the tester against any feedback from the live bus.

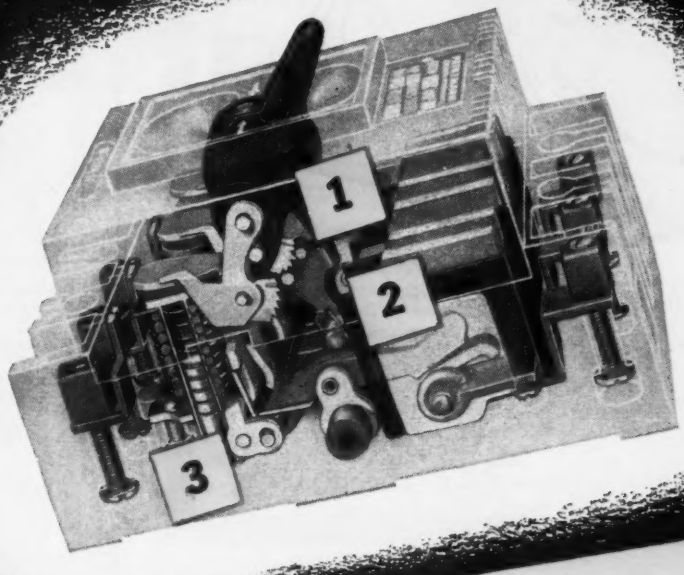
Making Best Use Of A Transformer Dryer

AN EASTERN UTILITY uses a transformer dryer with an electric heater rated at 22 kw. The heater has four sheath-wire units included in a sheet-iron casing, and terminal connections permitting use at 115 and 230 v. A motor-driven blower discharges air through the heater to the unit to be dried. Motor and blower are built into the device as a unit, no troublesome coupling being required. Blower intake supports a cone which may be covered with cheesecloth to filter the air supply. The 5¾-in. diameter cone is bolted to the heater outlet to receive a tube connecting the heater to the transformer to be dried.

The heater outfit is designed to deliver 800 to 850 cfm of air at 2 to 2.5 oz per sq in. at 80 to 90 C, with inlet air at 25 C. In practice the air delivered to the transformer is not allowed to exceed 90 C. A higher temperature is likely to injure the transformer insulation.

Temperature regulation is obtained by throttling the air discharge or varying the voltage across the heater units. The latter are "Calrod", 5,500-w each. Another method available is to arrange the discharge to deliver air into the transformer casing in such a way that some cold air is carried into the casing by injector action. In operation the heater units are cut out when the blower motor is stopped, thus avoiding fuse blow-

3 UNIQUE ADVANTAGES OF THE HEINEMANN MAGNETIC CIRCUIT BREAKER



1 —HIGH SPEED LATCH

One of the fastest operating latch mechanisms known. It functions with minimum friction, opening the breaker with the least mechanical delay and independently of handle operation.

2 —MAGNETIC HIGH SPEED BLOWOUT

It adds speed to the arc interruption. Magnetic blowout contacts are mounted in individual arcing chambers carefully insulated from each other. As the value of the current to be interrupted increases, the quenching effect becomes greater due to the intensified magnetic blowout field.

3 —MAGNETIC-HYDRAULIC TIME DELAY

HEINEMANN Magnetic Circuit Breakers are available with any one of three different inverse time delays controlled by a hermetically sealed trip unit. The breaker acts instantly on excessive overload or short circuit, but is not affected by minor overloads or temporary inrush current.

EST. HECO 1888

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For any job where *safety* counts—CROSBY CLIPS! For rigging cranes and derricks . . . connecting swing cable . . . guying poles and towers—CROSBY CLIPS. They're hot dip galvanized, and drop-forged. High side wings and channel grooved base assure perfect lay of the rope. And CROSBY CLIPS hold with a *vise-tight* grip. Sizes for wire rope from 1/8 inch to 3 inch. Sold by distributors everywhere. Made only by AMERICAN HOIST and Derrick Co., St. Paul 1, Minnesota.

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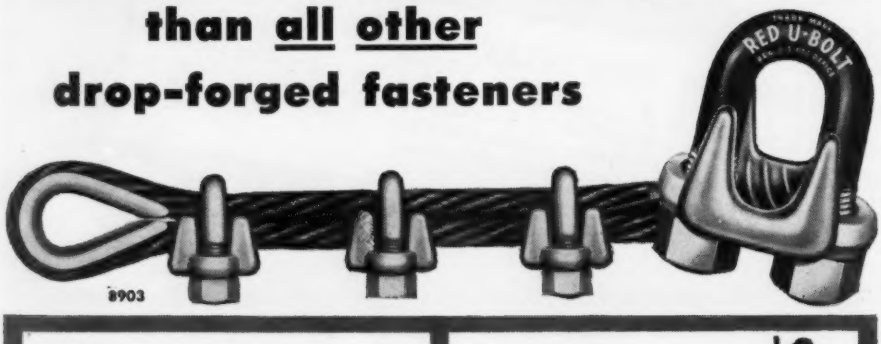
CROSBY CLIPS

than all other drop-forged fasteners

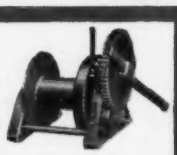


For Armored Construction . . . specify

AMERICAN BLOCKS AND SHEAVES

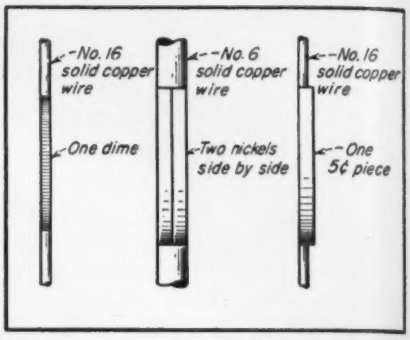
●A complete line of wire rope blocks—all types, all sizes, in capacities from 1½ to 250 tons. Thick steel side plates, heavy pins and axles. Ask for American equipment when ordering.

ONE MAN LIFTS 10,000 LBS. WITH THE AMERICAN HANDIWINCH



●Gives one man the power of a crew. Weighs only 95 lbs. Handles lifting, loading and pulling jobs up to 5 tons. All steel construction. Ask your distributor.

ing. The heating elements will carry 25 kw maximum when 800 cfm of air is passing through. Without this flow of air they quickly overheat. By removing the end cover, heating elements can easily be inspected and replaced.



WIRE sizes easily determined by small coins

Determine Wire Size By Using Loose Change

CHARLES C. HOKE
Engineer
Union Electric Co of Missouri
St. Louis

EVER GET CAUGHT out in the field without a wire gage and want to determine conductor sizes?

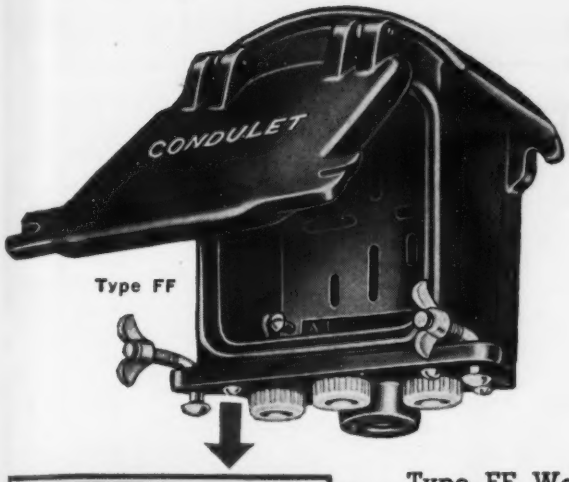
One simple solution is to pull the loose change out of your pocket and pick out two fairly new pennies, two nickels and two dimes. With these, wire sizes from 6 to 16 solid are easily measured.

If the conductor diam is equal to the thickness of a dime, the wire is No. 16 B & S gage; if equal to a penny, it is a No. 14, etc.

With four pennies, four nickels and four dimes, solid copper conductors up to 1/0 can be determined. With nickels, wires up to No. 4/0 solid or stranded can be measured.

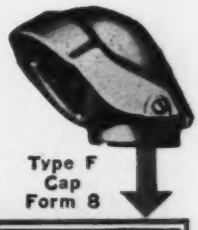
Coins And Wire Sizes
Solid Copper

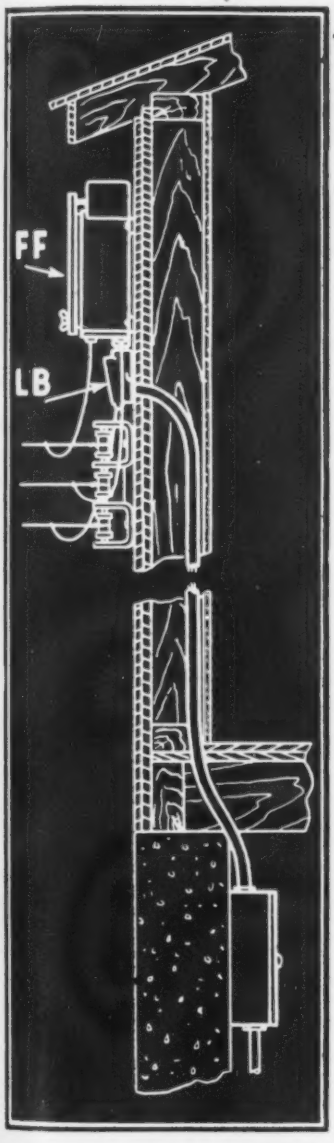
Wire Size	Dime	Pennies	Nickels
16	1	—	—
14	—	1	—
12	—	—	1
10	2	—	—
8	—	2	—
6	—	—	2
4	4	—	—
2	—	4	—
1/0	—	—	4
2/0	4	—	5
3/0	—	—	5
4/0	1	—	5
Stranded			
1/0	1	—	4
2/0	5	—	5
3/0	—	1	5
4/0	1	1	5



Service Entrance CONDULETS*

A type for every requirement





Type FF Weatherproof Service Entrance Condulet is ideal for over-current protection. Slotted mounting plate takes standard fuse cutouts.

This Condulet meets the recommendation of the 1947 National Electrical Code which states in Section 2331 that "service entrance conductors should not be run within the hollow spacing of frame buildings unless provided with automatic over-current protection at their outer end".

Type FF is made in three sizes: 30, 60, and 100-ampere, 250 volts.

Type F Service Entrance Cap is made in two forms: Form 8 in sizes from ½ to 2-inch and Form 6 in sizes from 2-½ to 6-inch.

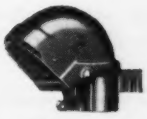
Illustrated below are other service entrance caps and fittings which may be selected from the many items listed in Crouse-Hinds Condulet Catalog.

* CONDULET is a coined word registered in the U. S. Patent Office. It designates a product made only by the Crouse-Hinds Company.

PROMPT SHIPMENT on small sizes

Type F Cap Form 6

Type FEE Cast Aluminum Cable Cap



Type FED Cable Cap

Type LB Service Entrance Elbow

Type BE Cap

Type FE 3-Part Cap

Type FBM Cap

Type LBC Service Entrance Tee for grounding with driven or buried electrodes

Type CGY Cable Connector

Type SP Sill Plate

Type FBM Cap for EMT

A Nationwide Distribution Through Electrical Wholesalers

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CONDULETS
FLOODLIGHTS
TRAFFIC SIGNALS
AIRPORT LIGHTING

CROUSE-HINDS

LIGHTING INTENSITY in Birmingham Electric Co office was raised from 14 ft-c (left) to 40 ft-c after relighting job

Utility Buys What It Sells In Planned Lighting

COMPLETE WITH detail drawings and specifications illuminated in color, exactly the same as offered to other prospects, was the proposal for relighting the offices and public rooms of the Birmingham Electric Co by the company's lighting sales engineers. The proposal even included the regular paragraph advising proper maintenance and inviting a call to the utility on any future problems. BECO as customer accepted the proposal offered by BECO as utility and the installation, costing $46,519, was made.

Evidencing that they had the customer's interests firmly in mind, the utility lighting engineers recommended the use of several different types of lighting fixtures so that they could be shown in operation to the customer's customers. Thus for the various work spaces on the seven floors of the building, 732 fixtures of 14 different designs, products of seven manufacturers, were specified.

The cost of the fixtures was $17,836, cost of installing and modernizing the wiring was $20,683 and the painting cost was $8,000.

Painting received special attention. The office walls are tinted in pastel shades on the basis of a minimum reflection factor of 50% and maximum from 55 to 60%. Above that produces glare. In the larger offices, and most of the small private offices, there are no two walls of the same color. All ceilings are flat white.

The paint shades were scientifically selected to reproduce these reflection factors. The color schemes were selected on the basis of restfulness to the eyes. No recess lighting was done because of concrete ceilings and a false ceiling to recess would have been a much too expensive undertaking.

In all office working areas, like the accounting department, there is a minimum of 40 ft-c. In private offices 40 ft-c is standard but in order to utilize various types of fixtures for tests and as demonstrations, the intensity is maintained by shielding as required.

BIRMINGHAM ELECTRIC CO DEMONSTRATION LIGHTING

			No. of Fixtures
First Floor			
Wakefield—"General"	G–260	2 100-w white F	67
Second Floor			
Wakefield—"Grenadier"	PG–2483	2 40-w white F	122
Westinghouse	LW–160 SLB	4 40-w white F	4
Third Floor			
Daybrite—"Viz-Aid"	46203	2 40-w white F	108
Westinghouse	LW–160 SLB	4 40-w white F	12
Fourth Floor			
Westinghouse	LW–160 SLB	4 40-w white F	42
Westinghouse	CL–40	1 40-w white F	28
Pittsburgh-Jefferson	A–1240	2 40-w white F	6
Wheeler	7021	2 40-w white F	5
Fifth Floor			
Daybrite—"Viz-Aid"	46203	2 40-w white F	95
Leader—"Research"	LR–440	4 40-w white F	3
Sixth Floor			
Pittsburgh-"Jefferson"	A–1240	2 40-w white F	83
Wakefield—"Stars"		2 40-w white F	8
Curtis	Firefly	4 40-w white F	4
Westinghouse	CL–40	1 40-w white F	10
Wakefield	B–4488A	4 40-w white F	4
Curtis—Starlux	1400	4 40-w white F	1
Daybrite—"Kingsway"	1A4 & 1B2	6 40-w white F	3
Leader—"Research"	LR–440	4 40-w white F	3
Seventh Floor			
Wakefield	PG–2483	2 40-w white F	124
		Total	732

INTRODUCING
The First Really

NEW and DIFFERENT

FLUORESCENT FIXTURE

The Achievement of GUTH'S 45 Years of Lighting Leadership

Guthlite*

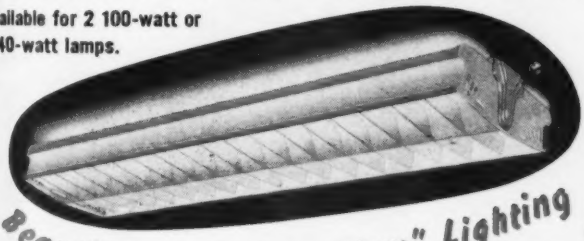
—for Better Sight

Featuring the Exclusive "Jacknife" Hinge!

Installation Is Fast... Easy!

The ballast-free channels are hung first—either on the ceiling or suspended—singly or in continuous rows. Then follows simple, straight-through, unobstructed wiring. Finally, the complete reflector unit, which contains reflector, ballast, starter, wiring, lamp holder, lamps, and louvres, is put up in one simple, hook-on operation. That's all there is to it!

Available for 2 100-watt or 2 40-watt lamps.



Beautiful "Radiant Glow" Lighting

The GUTHLITE provides efficient, glareless, down light, comfortably pleasing ceiling light, and beautiful soft-lighted sides. There are no horizontal light-reflecting surfaces to gather dust.

The reflector and Exterior are finished 300° PERMALUX WHITE, with satin finish ALZAK aluminum louvres, polished aluminum end ornaments, (removable when used in continuous rows), and decorative die-cut light windows in ends. A truly beautiful luminaire. Write today for detailed information—Bulletin No. 1845C.

Lamps Replaced— Starters Changed— Reflectors Cleaned— All Right from the Floor! No Ladders—No Fuss!

Here is the fluorescent fixture that solves, once and for all, every problem in fluorescent lighting! Easy and fast installation. Simple, safe, time-saving maintenance. A fixture that symbolizes the progressive, forward-looking achievements of GUTH—pioneers in lighting!

"Jacknife" Hinge Makes It Simple to Service As *1-2-3!*

1—A twist of the wrist opens the spring latch—releases the reflector unit to swing down, smoothly and safely, on the "Jacknife" Hinge.

2—Reeled spring counter-balance reflector channel; means easy lowering and raising. Circuit is broken as soon as Fixture is opened.

3—From the floor, lamps and starters can be changed; reflectors and louvres can be dusted. As an added feature, the entire channel can be unhooked and removed for thorough washing.

THE EDWIN F. GUTH CO. • ST. LOUIS 3

Leaders in Lighting Since 1902

Guth

*Trade Mark. U. S. & Canadian Patents Applied for

before you select a pension plan

see EBASCO... for impartial advice

THE PROBLEM:

To evaluate your pension requirements in respect to

- Type of plan—available methods of financing
- Desirability of change in present program
- Comparative costs of alternatives
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THE SOLUTION:

Let EBASCO help you make sound decisions

- It is neutral—it is not in the business of selling pension plans
- It is able to install the plan you choose, and follow through with *continuing* advice and actuarial service to maintain it
- It is equipped to prepare, in acceptable form, the annual "Certification of Adequacy" of contributions to pension trusts

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And Now, The Electric Egg Cleaner

EGGS THAT LOOK BETTER and keep longer than those washed by hand come out of this electric cleaner. Power-driven, lightly-abrasive disks, moistened with hot water, take the dirt off the eggs which are then dried quickly by a blast of electrically-heated air. Patent rights in the cleaner have been assigned to the Cornell University Research Foundation. It is expected that the machine will be available commercially soon

Electric Service Forces Flower Bulbs

OVER 2 MILLION flower bulbs are forced each year by florist William H. Stimming. Resulting blooms—tulips, iris, daffodils and others—mount up to between 3 and 4 million. At his Newark Valley, N. Y., plant he has recently built an electrically air-conditioned storage house, 132 ft long and 32 ft wide. Here, about 20% of his production is held during the forcing season, September to April. This is believed to be the largest project of its kind. Problems of design and equipment were solved by advice from the York Refrigerating Co, Sullivan Brothers & Lent, the contractor, and the New York State Electric & Gas Corp, whose farm service representative, J. Kent Blair also appears in the picture. Refrigerating equipment consists of 2 Freon compressors driven by 5-hp motors

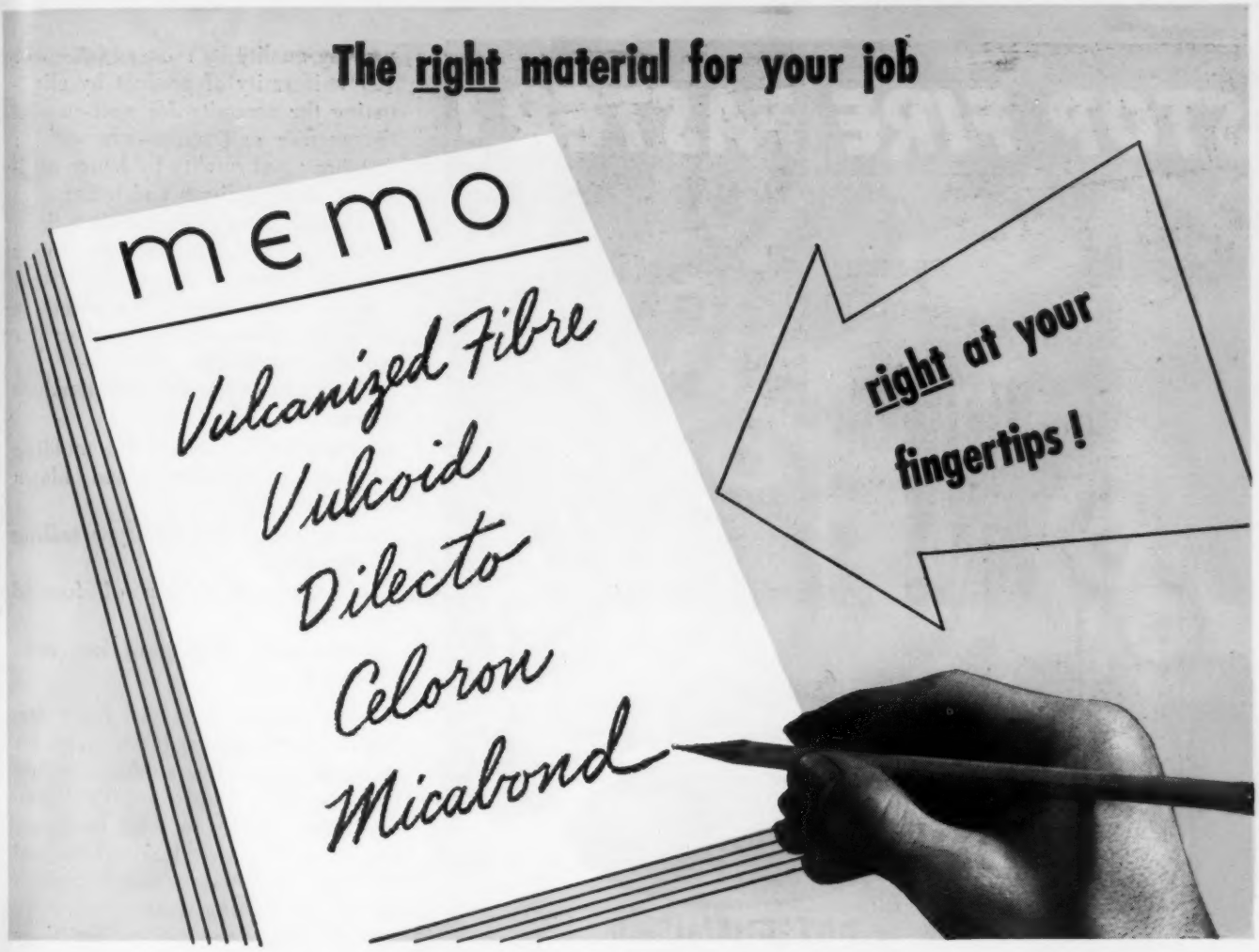
High Frequency Heating Aids Rubber Industry

CAREY MANN*
Mgr Engr and Service
Westinghouse Electric Corp
Cleveland, Ohio

POSSIBLE ADVANTAGES of high frequency heating in the rubber industry include: (1) quicker heating of the mass, thus decreasing time and im-

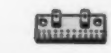
*From "Radio Frequency Application in the Rubber Industry," presented before Akron Rubber Group of the American Chemical Society.

The right material for your job



How to Save 2 Ways with an Engineering Service that Always Gives You *Unbiased* Recommendations

First, you save production hours and dollars because you can be sure of getting electrical insulating materials that are "right for your jobs." That's because Continental-Diamond makes a complete range of products with the physicals you want. Instead of having only one, two, or three materials to recommend, C-D offers you a choice of five different insulating materials subdivided into grades or combinations of grades to fit your specific applications. Thus, you stand a much better chance of getting the one material that will reduce fabricating costs and improve product performance because it's right on the job.



Second, you save time and effort because you have a convenient, "one-stop" source for all your electrical insulating needs. To give you fast, complete shipment, large stocks of every C-D product are constantly kept on hand. And, if you request it, trained C-D technicians can give you practical, personal help that can lead to better, lower-cost applications. Save two ways, today. Call or drop us a line for anything you need in the way of top-quality electrical insulating materials.

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Continental-Diamond FIBRE COMPANY

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STOP FIRE FASTER!

WITH THE MASTER OF FLAME ANSUL* FIRE EXTINGUISHING EQUIPMENT

ANSUL MODEL 350 A

DRY CHEMICAL

FIRE EXTINGUISHERS

MORE AND BETTER FIRE PROTECTION FOR YOUR FIRE EXTINGUISHER DOLLAR

Ansul Dry Chemical Fire Extinguishers give you more protection . . . pound for pound . . . dollar for dollar . . . than any other extinguisher of comparable size.

In addition . . . Ansul Fire Extinguishers provide the best first-aid protection:

- For electrical equipment hazards . . .

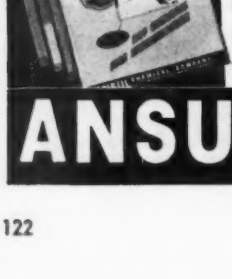
TRANSFORMERS, GENERATORS, CIRCUIT BREAKERS, MOTORS, ETC.

Ansul Fire Extinguishers have the highest established ratings for effectiveness on flammable liquid fires, based on tests by nationally recognized approval agencies. The longer range stream of dry chemical is effective in winds and drafts.

After use, Ansul Dry Chemical Fire Extinguishers can be recharged "on the spot" . . . providing continuing protection . . . and annual recharging of Ansul extinguishers is NOT necessary.

Safe to use . . . non-toxic, non-corrosive, non-abrasive.

Ansul Dry Chemical Fire Extinguishers are preferred fire protection in the utilities field and for electrical equipment hazards in all industries.



Ask for your copy of file No. 204. You will receive factual data on how Ansul Dry Fire Chemical Extinguishers will cut your fire protection costs.

Listed and approved by Underwriters' Laboratories and Factory Mutual Laboratories.

Ansul Model 30

Ansul Model 20

Ansul Model 4

ANSUL CHEMICAL COMPANY
FIRE EXTINGUISHER DIVISION, MARINETTE, WISCONSIN
DISTRIBUTORS IN ALL PRINCIPAL CITIES

proving quality by reduced pre-cure; (2) uniformity of product by eliminating the necessity for over-cure at the surface and under-cure within; (3) improved quality by better utilization of ingredients and better cure throughout; (4) shorter process time, resulting in labor savings, lower equipment costs, and less floor space; and (5) lower ambient temperatures in work areas resulting in better working conditions.

Successful general applications include:

1—Pre-heating for transfer molding of both hard rubber and blown sponge material.

2—Continuous and bar type sealing of thin films.

3—Curing and drying of foamed latex sponge.

4—Continuous curing of low pressure materials.

Most applications of high frequency in the rubber industry are for pre-heating molding stocks to reduce press-time and improve the uniformity of cure. Molds for high frequency curing require electrical and thermal characteristics comparable to those of the product being treated.

For high pressure curing there must be mechanical strength to resist the pressure required by the process. Materials must be reasonably easy to form and must withstand repeated temperature and pressure cycles.

Low pressure curing forms, such as for foamed latex, have been successfully produced with impregnated glass fibre. One may consist of a complete box-and-cover type; or. the aluminum electrodes may serve as the top and bottom with a dielectric material used as the edge contour control.

For uniformity of electrical characteristic, uniformity and fineness of ingredients are important. This, with more uniform reaction, generally results in better utilization of sulphur. Thus less is needed. In turn, variation of sulphur content materially affects the dielectric characteristics. If carbon black is present, particular attention must be given to its uniformity and mixing. Properly done, high frequency cures can be successful with as high as 45% carbon black.

Maintenance of industrial electronic equipment offers no big problem. Most installations of such equipment follow existing industrial practice.

Type L (Synchronous)
$23.00 LIST
TRADE DISCOUNTS APPLY

Type WH
(Synchronous Carryover)

Sangamo Time Switches, widely known for their dependability, are now better than ever! The Type L synchronous and the Type WH synchronous carryover switches, pictured above are the two new basic time switch units in the Sangamo line. They can be adapted to a wide range of applications by the inclusion of an omitting device, advance time cutoff, astronomic dial, and two circuit type construction.

These improved Sangamo Heavy-Duty Time Switches are available for immediate delivery.

Bulletin 1060M gives full information and prices. A copy will be sent upon request.

ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

NEW EQUIPMENT

Single-Phase Motors

A SINGLE-PHASE Life-Line capacitor-start, induction-run, squirrel cage motor is available from Westinghouse Electric Corp, Pittsburgh 30, Pa., in ratings of ¾ to 7½ hp. The Type CAP motor can be used for practically any single-phase application.

This motor is all-steel construction—steel frame, feet and end brackets. Air openings are in the lower half of the end brackets to give full protection against dripping liquids. Self-sealed, prelubricated ball bearings are stated to provide effective lubrication for 5 years or longer without repacking.

The line is available for single-phase, 110/220 v dual voltage (frames 203-225), 110 or 220 v single voltage (frames 254-324); 3450, 1750, 1160 rpm for 60 cycle, 2875, 1475, 970 for 50 cycles and 1450 RPM for 25 cycles; 40 C rise continuous duty on 60 and 25 cycle, 50 C rise continuous duty on 50 cycle.

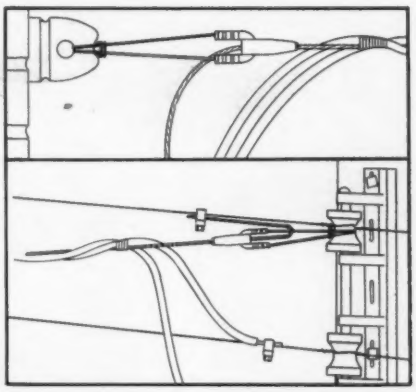
•

Service Cable Dead End

FOR USE WITH self-supporting cable run in service drops, a dead end device Cat SDE has been developed by Fargo Mfg Co, Poughkeepsie, N. Y. The device provides a means of fastening the cable to the house bracket at one end and to the secondary rack or hook at the pole end.

The unit consists of an Everdur casting in which is placed a one-piece four-jaw gripping part. The flexible bail is made of ⅛-in. 49-strand phosphor bronze cable. The messenger can be run straight through and bent back for connection to the customer's service riser and the pole secondaries.

For the ⅛-in. 49 strand, minimum strength when looped as shown in illustration is reported to be 1,100 lb. The bail wire is held in the casting by means of a wire compression indentation.



Sizes available cover the range from No. 6 solid to No. 2 solid wire and for the common sizes of Copperweld copper. Standard length of bail wire is 11 in.

•

Trench Diggers

TWO NEW DITCH-DIGGING machines have been added to the products of Barber-Greene Co, Aurora, Ill. Model 710 is reported suitable for extending electric, gas and water lines.

The ditcher is a self-propelled unit with tractor thread and has travel speed up to 234 fpm. A three-position boom is adjustable (left, center or right) to dig close to obstructions. Trenches up to 5½ in. wide and 42 in. deep can be dug at speeds up to 32 fpm. A cable-laying attachment is available for feeding cable and plowing over the soil in one continuous pass. An overload release is provided to prevent damage from boulders. Boom is equipped with hydraulic hoists for power lift and controlled gravity lowering.

Model 720 is available for digging trenches 8 to 11 in. wide and to 4 ft deep.

•

Luminaires

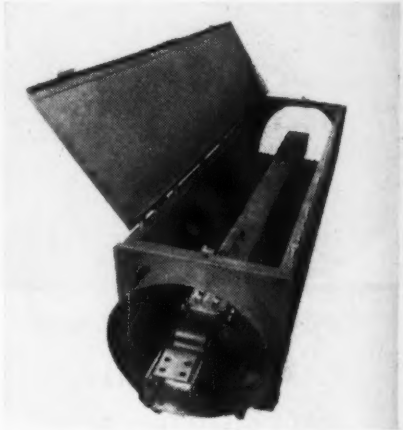
A LINE OF luminaires for use with 72 and 96-in. Slimline lamps is being produced by Art Metal Co, 1814 East 40th St, Cleveland 3, Ohio. Known as the Astralux units they are available in either 2 or 4-lamp arrangements, and may be suspended or close-ceiling mounted in either individual or continuous row systems.

These semi-indirect lighting units utilize panels of ribbed polystyrene plastic as the shielding and reflecting media. The panels are in 2-ft sections, interrupted by decorative cross ribs of polished cast aluminum and by a wedge-shaped center strip of satin aluminum.

•

Aluminum-Enclosed Bus

AN ALUMINUM-ENCLOSED isolated-phase bus run for interconnection at generators, transformers, and switchgear equipments has been announced



by the Switchgear Division of the General Electric Co. The equipment is available for 15-kv applications in current ratings of 1200, 2000, 3000, 4000, and 5000 amp, and has a basic impulse level of 110 kv. It may be used for indoor or outdoor installations. It is tested and assembled to meet AIEE and NEMA standards.

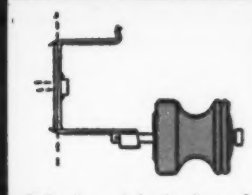
Each phase of the bus runs as a single aluminum sheet shaped to form three sides of the housing. The fourth side consists of a gasketed and clamped cover which is hinged.

The bus is shipped in sections completely assembled. End bells of adjacent sections are connected by split aluminum bands having gasketed mating flanges. In addition to making a tight joint, the gasket arrangement is said to break up circulating current paths.

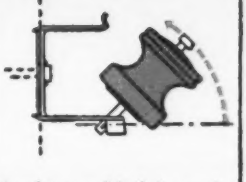
To form a length of 3-phase bus run,

Something NEW IN SECONDARY DISTRIBUTION

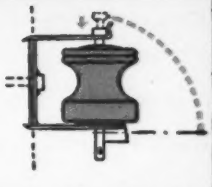
HUBBARD SAGGER BRACKETS



Side view of the horizontal or "sagging" position. Note that insulator bolt is solidly checked against further downward movement.

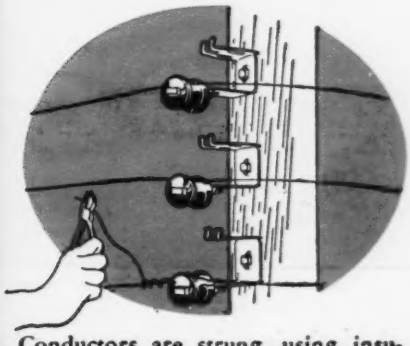


Insulator and bolt in semi-closed position. It must clear the keepers at the top to complete closing.

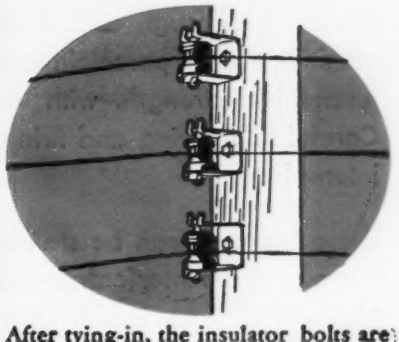


Closed position. Note that insulator bolt is solidly locked in this position, having been pushed down past the spring keepers.

Holes are drilled at correct spacing and machine bolt is inserted as shown.



Conductors are strung, using insulators as pulleys, until desired sag is obtained after which they are tied-in while still in the horizontal position.



After tying-in, the insulator bolts are raised to the vertical and dropped into the lock position.

For secondary distribution circuits, where a variety of problems are to be met, Hubbard No. 710 Sagger Bracket is the most flexible choice to meet the requirements. This Bracket may be described as a single, *separate,* secondary-rack point, which may be used with one or more similar points, at any desired spacing for any number of conductors.

No. 710 Brackets are versatile in other ways also. The patented feature is the arrangement of the insulator bolt which may be dropped to a horizontal position to allow the "sagging" of conductors with the insulator spool acting as a pulley. Insulator Bolts are locked in position when closed or open. Strength against line pull is provided by the broad back bearing against the pole, the backs being 3-inches in width. Spurs at the corners prevent the bracket from turning during and after installation. Bolt heads are trapped in the back to prevent turning while tightening.

Hubbard Sagger Brackets have been tested and proved in service. Highly adaptable to any conditions, they have drawn praise from engineers, in every instance of the many installations made to date.

HUBBARD AND COMPANY

PITTSBURGH · CHICAGO **OAKLAND · CALIFORNIA**

A chain is only as strong as its weakest link. Prevent weak links in your product by using ILLINOIS bushings produced to meet your engineers' most exacting specifications.

ILLINOIS' thorough control of production methods results in the manufacture of porcelain bushings of high dielectric and great mechanical strength, with the utmost in dimensional accuracy. Careful kiln drying and firing, at constant temperatures, prevent internal stress.

These bushings can be standard glaze or radio interference-proof glaze. Dry type bushings are produced for all voltages up to 34.5 kv. Gasket seats are smooth and ground when required.

★

Complete Uniformity
Exact Dimensions
High Dielectric Strength
High Mechanical Strength

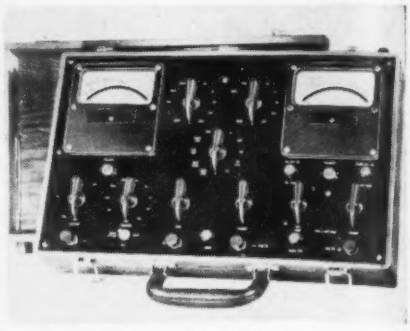
★

Specify Illinois Porcelain
for Dependability and Economy

ILLINOIS
ELECTRIC PORCELAIN CO.
MACOMB • ILLINOIS

three housings are bolted to cross members made from aluminum H-beams. The steel plate brackets supporting the insulators are braced apart by these same cross members. Necessary structural steel members for attaching the H-beams to the building structure are supplied.

•



Electrolysis Meter

FOR ELECTROLYSIS and corrosion investigations and cathodic protection testing, a multi-combination meter has been developed. Known as model No. 5 and weighing 23 lb, the versatile instrument has been made available by M. C. Miller, 1142 Emerson Ave, West Englewood, N. J.

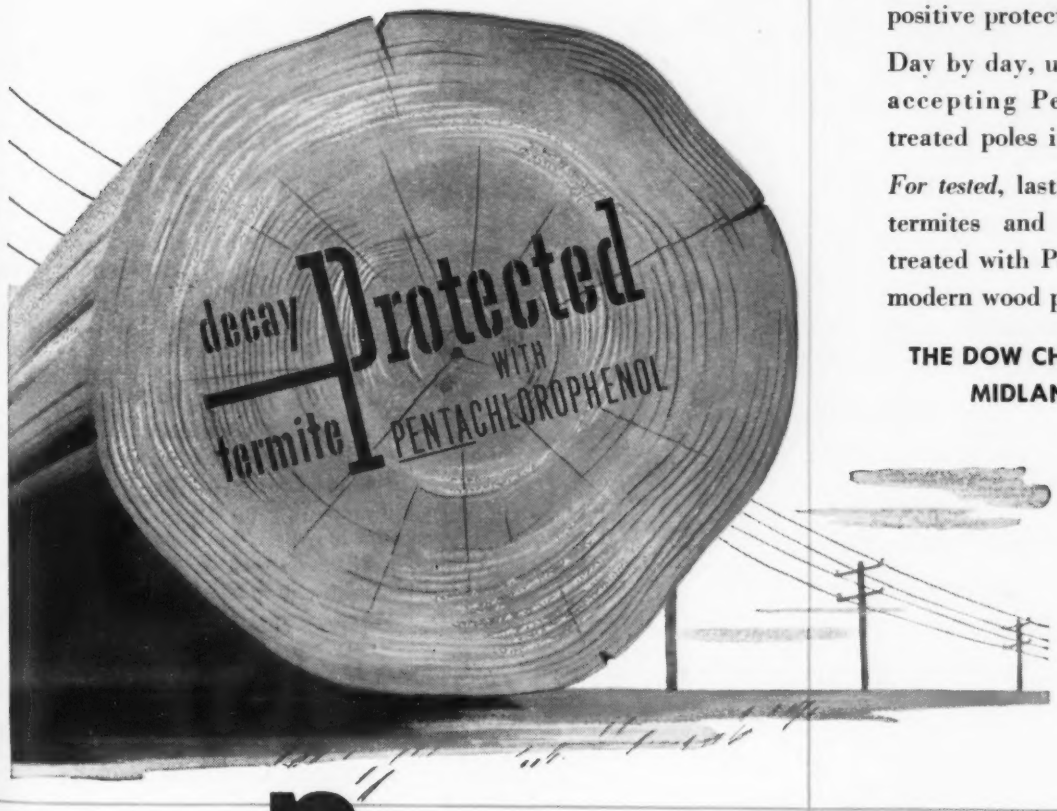
The unit has voltmeters with scales for ranges from 2 mv to 100 v, and sensitivity 3,000 and 62,500 ohms per v; a battery-operated, vacuum-tube voltmeter 100 mv to 10 v; ammeters with scale ranges from 1 ma to 20 amp; a zero-resistance type 2-amp ammeter with battery; selector and polarity reversing switches; a d-c biasing potential for "back-to-zero" galvanic potential.

•

Lineman's Suit

A TWO-PIECE waterproof lineman's suit has been introduced by the Interstate Manufacturing Co, Hudson, Mass. It is reported to be resistant to rain,

You get a CLEAN treatment with PENTAchlorophenol!



Men who maintain communication and powerlines appreciate working with clean, Pentachlorophenol-treated poles that are easy to handle.

Pentachlorophenol is the scientific wood preservative that gives *measured* positive protection.

Day by day, utilities everywhere are accepting Pentachlorophenol—treated poles in increasing quantity.

For tested, lasting protection against termites and decay specify poles treated with Pentachlorophenol—the modern wood preservative.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

3 MORE BIG PENTAchlorophenol advantages

1. You know what you're getting with Pentachlorophenol-measured, dependable, preservative action.
2. You can duplicate service records. Treating solution is scientifically controlled.
3. You get full strength preservative. Pentachlorophenol is uniform and unchanging.

DOW

CHEMICALS INDISPENSABLE
TO INDUSTRY AND AGRICULTURE

MOSINEE PAPER MILLS CO. MOSINEE, WISCONSIN REG. U.S. PAT. OFF.

MOSINEE

"More than Paper"

In the field of electronics and the electrical goods industry, MOSINEE stands for paper-base processing materials with scientifically controlled chemical and physical properties, high quality standards and dependable uniformity... with good dielectric strength, high tensile or tear strength; proper softness or stiffness; creped with controlled stretch or flexibility; specified pH for maximum-minimum acidity or alkalinity; accurate caliper, density, liquid repellency or absorbency . . . or other technical characteristics vital to your quality standards and production requirements.

MOSINEE PAPER MILLS COMPANY • MOSINEE, WIS.

"Essential Paper Manufacturers"

wind. hail and sleet, and to meet approved safety tests.

Material is a double textured fabric, heat cured. The suit is said to be lightweight and roomy and is designed to be worn over regular clothing. Jacket has hooded parka, gusseted neck and sleeves. Waterproof accessories include clothing bags, glove bags and small part pouch.

•

Emergency Lighting Unit

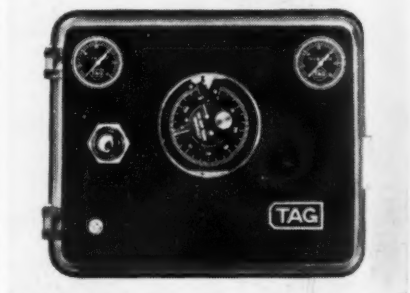
A PORTABLE self-contained emergency lighting unit has been designed to furnish light instantly and automatically by power from its battery when the usual source of current fails. The unit known as the Minuteman is available from Electric Cord Co, 30 Church St. New York 7, N. Y.

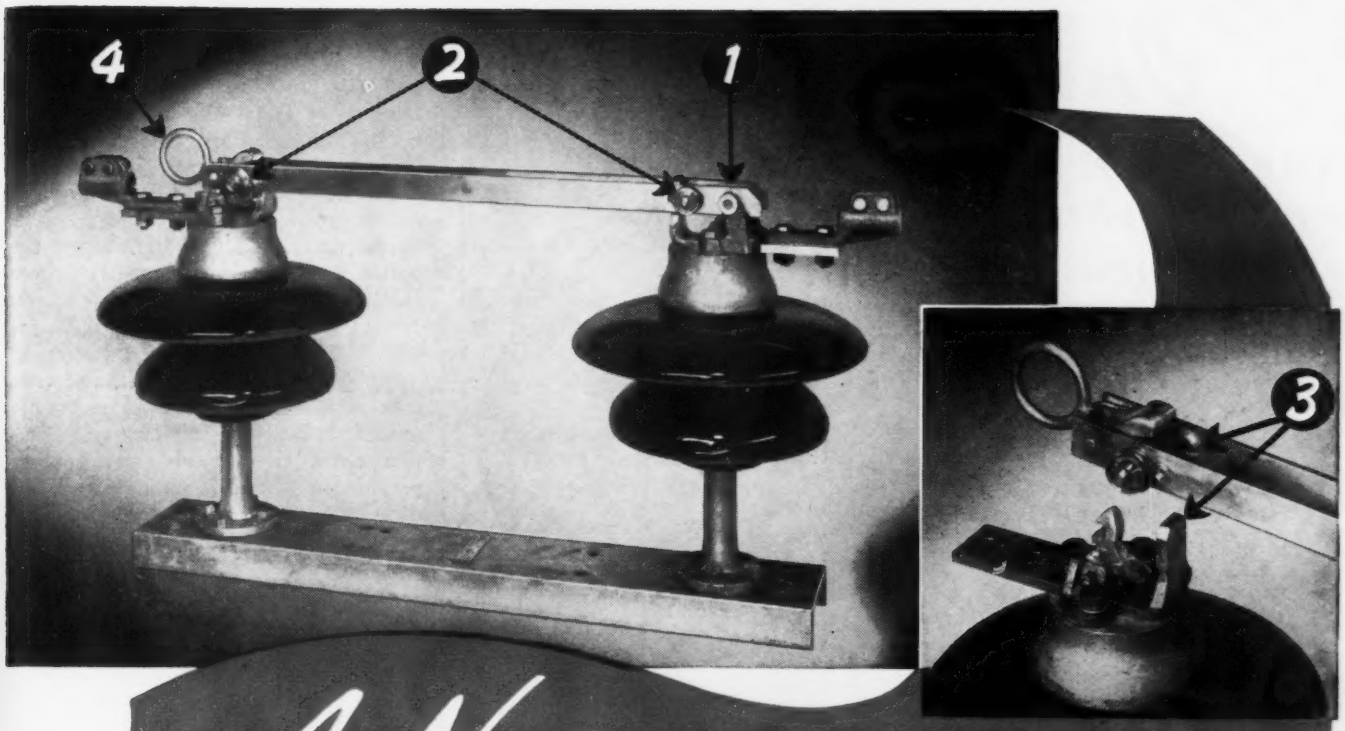
Connection can be made to a convenient outlet. Each lamp consumes 100 w and is said to be capable of illuminating an area of approximately 10,000 sq ft for about 5 hr. Lamp heads are adjustible to any position and can be removed for installation nearby. When normal current is resumed, the lights are de-energized automatically and a built-in charger restores power to the battery.

•

Process Control Timer

TO MAKE A process automatic, a time-schedule controller has been developed. According to the manufacturer, it can





A New Hi-Voltage HOOK OPERATED SWITCH...

with 4 CONSTRUCTION FEATURES THAT ASSURE CERTAIN OPERATION

Here is an entirely new line of out-door, hook-operated disconnecting switches built by Hi-Voltage. These switches are manufactured in all capacities from 400 to 2000 amperes and 7,500 to 115,000 volts.

This new line incorporates four construction features in keeping with the traditional high quality and certain operation afforded by all Hi-Voltage Switches.

Look over these advantages . . . they are reasons for the continued superiority of Hi-Voltage in the air switch field.

1. ***Independently Hinged Blades***—On the 400 to 1200-ampere switches, the blades are carried on a hinge which is entirely independent of the hinge end contact. In this manner, misalignment sometimes resulting from installation, cannot affect the smooth operation or the positive conductivity of these switches.

2. ***Stainless Steel Contact Springs***—On all switch models, contact pressure is maintained by stainless steel compression springs of ageless flexibility. Moisture cannot rust them, nor interfere with the maximum conductivity they develop.

3. ***Silver Nickel Contacts***—On all switch models from 600 to 2000 amperes, contacts are silver-nickel welded to copper . . . non-gauling . . . corrosion proof . . . best for conductivity.

4. ***Pry-Off Lock Action***—The lock is strong and positive. Its pry-off action guarantees easy opening under ice conditions and when the location of the switch necessitates a pull with the switch stick almost parallel with the blade.

Get the complete story on this new line of Hook Operated Switches. For additional interesting and factual information, write to:

Hi-Voltage EQUIPMENT COMPANY

4000 EAST 116TH STREET • CLEVELAND 5, OHIO

Investigate...

THE FISHER-PIERCE PHOTOELECTRIC CONTROL FOR MULTIPLE STREET LIGHTS

NEW LIGHT ON THE PROBLEM OF STREET LIGHTING

The Fisher-Pierce Company — specialists in electronic applications — offer a new control — a simplified Automatic Photoelectric Unit for Multiple Street Light Control.

The interest already shown by hundreds of utilities in such a development centers around these features:—

1. **Flexibility** — individual street lights can be connected directly to 120-volt distribution lines.
2. **Lower Costs** in service and maintenance compared with other methods of control.
3. **Quality** of lighting service secured.

With FISHER-PIERCE PHOTOELECTRIC CONTROL it is possible to preset the value of illumination at which it is desired to turn on the lights— lights so controlled will go on at that value of illumination day after day regardless of specific location, weather conditions, or obstacles.

Technical Characteristics & Features — This control operates dependably down to less than 1 foot-candle. It has a built-in differential and time delay to avoid operation by lightning, clouds or cycling—absolute minimum of components. Contact rating 500 watts—up to 3000 watts with auxiliary contractor.

Maintenance Procedure — Routine maintenance necessary only once per year — in addition to its technical advantages, plug-in replacement eliminates the need for service on the pole and permits full utilization of skilled technician's time.

Installation — Heavy galvanized mounting bracket fastens directly to distribution pole.

This control may also be used for Outdoor Advertising—Yard Lighting—Radio Towers—Airport Beacons and Lights—Warning Signals—Underpasses—Merchants Signs—Indoor Light Control.

Write for Bulletin FP61300 for further information.

Units can be shipped from stock.

FP FISHER-PIERCE COMPANY

82 CEYLON ST., BOSTON 21, MASS.

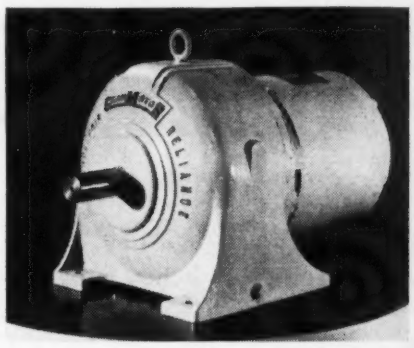
be synchronized with any system of air-operated semiautomatic temperature and pressure control now in use. This latest type TAG unit is a product of C. J. Tagliabue Corp (N.J.), 614 Frelinghuysen Ave, Newark 5, N. J.

In use, the operator begins the process by pressing the starter push button on the timer. A signal light above the button flashes on to indicate the process is under way. By means of an adjustable cam, temperature can be maintained for a predetermined length of time. Valves are operated as the process may require and manual adjustments are eliminated, it is claimed. At completion of the process and cooling period, the signal is extinguished, indicating visibly that the process cycle has been completed.

•

Gearmotor

A COMBINED MOTOR and gear reducer element, known as a gearmotor, has been developed and will be produced jointly by Reliance Electric and Engineering Co, Cleveland 10, Ohio and Philadelphia Gear Works, Inc, Philadelphia, Pa.



The new helical type horizontal integral units consist of a-c or d-c flange-mounted motors, each available with single, double and triple-reduction gears. They are designed to be built in six basic units or diameters capable of delivering from 1 to 60 hp and having speeds in ranges from 7½ to 780 rpm.

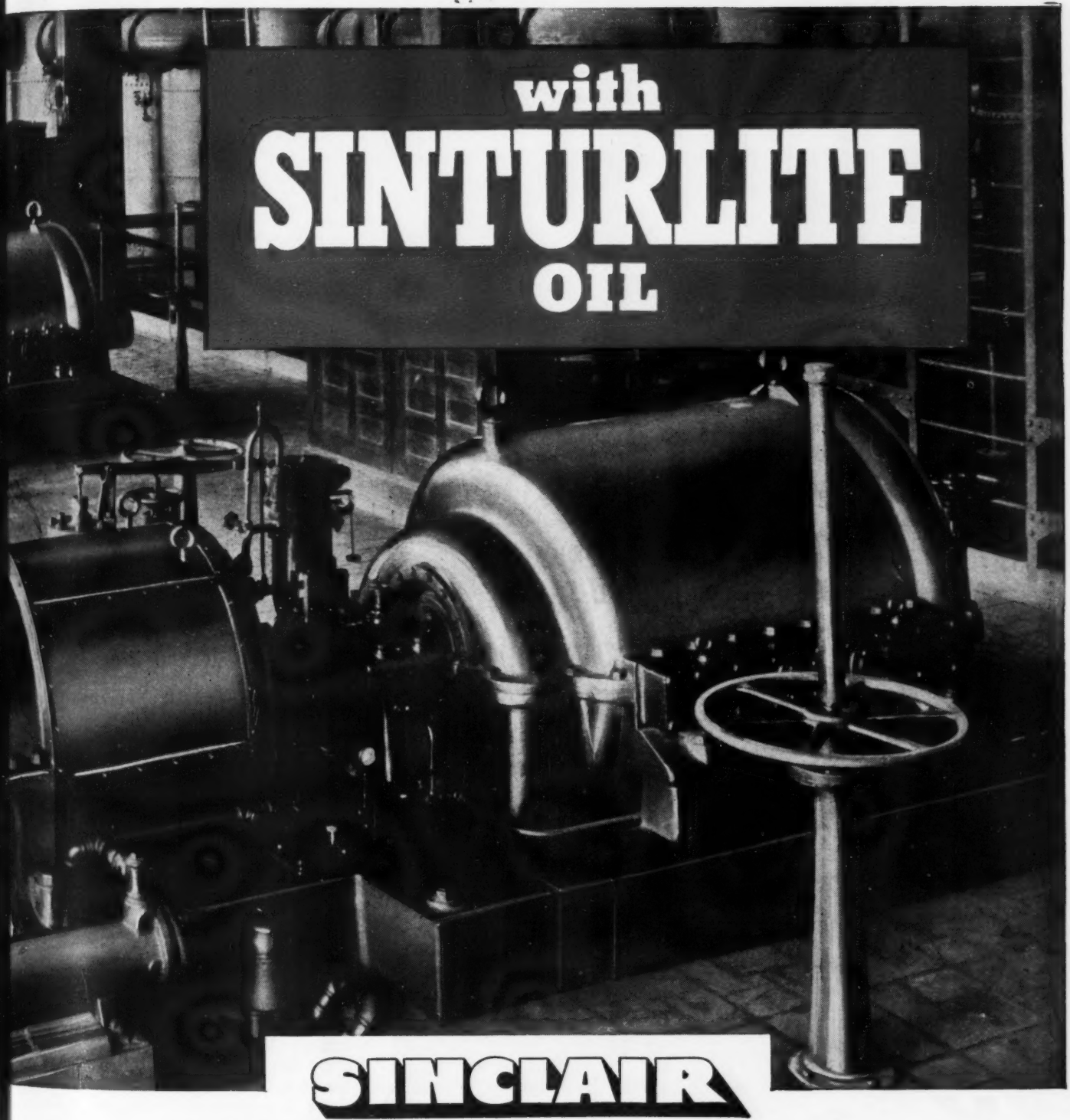
The arrangement permits standard or special motor-enclosure types to be used. Single-stage gearmotors have five gear ratios. A 3-stage gearmotor has a single-stage reduction assembly added to a 2-stage gearmotor; and only two gear ratios are said to be required in the final reduction. The simplification is reported to reduce the number of gears to 42 from 324 for a previous design.

•

Hanging Transformers

A NEW COMPACT indoor window hanging transformer series has been announced by the Jefferson Electric Co, Bellwood, Ill. Besides the type pro-

..and STAY RIGHT



SINCLAIR
INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL
WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVE., NEW YORK 20, N. Y.

MAINTENANCE COSTS SLASHED
Many Years of Service Prove Koppers Pressure-Creosoted Poles Key to Big Savings
Koppers Pressure-Creosoted Poles, the treatment proven over many years of service, are a logical part of intelligent Maintenance Saving Programs. These Poles, acknowledged as most dependable, have a record of long life and low costs. Users report installations 30 to 50 years old still in good condition. Prompt delivery from conveniently located treating plants and ample facilities permit stocking of all needed quantities and sizes for contract treatment or out-of-stock shipments.

KOPPERS

PRESSURE-TREATED WOOD

KOPPERS COMPANY, INC.

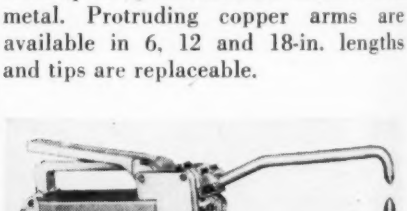
PITTSBURGH 19, PA.

vided with the usual cord and plug, this Series 727 includes types for use where local restrictions prohibit plug-ins. This has a ½-in. threaded pipe fitting for rigid conduit or flexible conduit connections and is provided with 48-in. leads. Opposite end of this transformer is equipped with a standard switch and pull chain. Both the cord and plug, and pipe outlet models are available in four ratings, 9,000, 7,500, 6,000, and 5,000 v, 18 ma.

•

Portable Spotwelder

A SELF-CONTAINED spotwelder, weighing 23 lb, is being made by Greyhound A-C Arc Welder Corp, 604 Johnson Ave, Brooklyn 6, N. Y. It is reported to weld up to ⅛-in. combined thickness of metal. Protruding copper arms are available in 6, 12 and 18-in. lengths and tips are replaceable.



Each portable unit has a transformer with spun-glass insulated wire, is obtainable for 220 or 110-v service, and is supplied with 10 ft of cable.

•

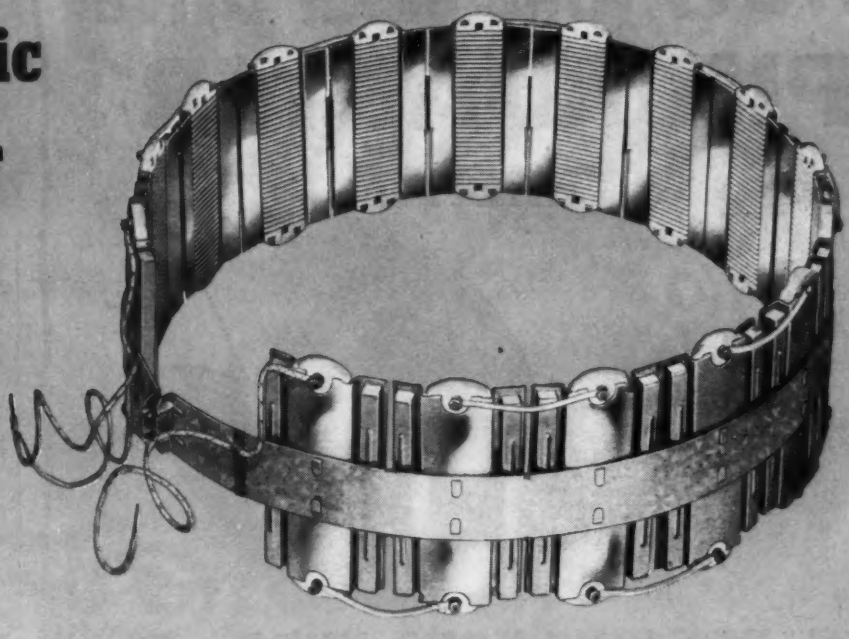
D-C Microammeter

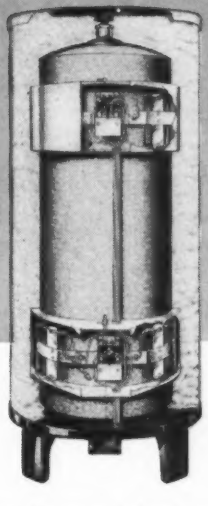
AN ULTRA-SENSITIVE electronic microammeter, capable of measuring direct currents down to one-billionth of an ampere, has been announced by the Tube Department of Radio Corp. of America, Camden, N. J. The new type WV-84A microammeter is a portable, battery-operated, vacuum-tube meter, designed for use in industrial and scientific laboratories.

Current ranging from 0.001 microampere to 1000 microamperes can be measured with six range settings. Current sensitivity is said to approach that

ELECTRIC "LIFE BELTS"

for domestic hot water heaters





When water in municipal systems contains dissolved minerals and chlorine, it becomes a fairly efficient electrolyte.

To avoid electrolytic corrosion which may occur if dissimilar metals are in contact with the water, the Toastmaster Water Heater employs "LIFE BELT" heating elements attached to the outside of the tank. In such an application, the ability of the elements to give long, trouble-free, economical service rests solely upon the quality of the electrical resistance material used. To assure top-level performance for a lifetime, the McGraw Electric Co., maker of the Toastmaster Water Heater, specifies Nichrome.*

The tank of the Toastmaster Heater is further protected by McGraw's new "Ionodic" system of corrosion prevention, where a magnesium rod anode, immersed in the water, saves the cathodic material of the tank from electrolytic attack.

Thus the manufacturers are able proudly to state: "We guarantee the Toastmaster Electric Water Heater for 10 years, and we deem this to be a conservative commitment. Many water heaters made by this company are still in daily use after several times this length of service, and elements in the old water heaters show little wear and no loss of efficiency."

Profit by the example of the McGraw Electric Co. and specify Nichrome. And remember, Driver-Harris manufactures over 80 alloys designed to fill the numerous requirements of the Electrical and Electronic industries . . . fully described in our catalog R-46.

Nichrome is Manufactured only by

Driver-Harris Company

HARRISON, NEW JERSEY

BRANCHES: Chicago, Detroit, Cleveland, Los Angeles, San Francisco, Seattle

Manufactured and sold in Canada by
The B. GREENING WIRE COMPANY, LTD., Hamilton, Ontario, Canada

*T.M. Reg. U. S. Pat. Off.

NEW Universal Drive PIN ADAPTER*

by ACROMETAL

HELPS SOLVE YOUR WIRE TAKE-OFF PROBLEMS... FITS 2" TO 6" SPOOLS

The job of de-reeling wire from the package spool has always meant problems for the wire user. Now Acrometal's new Universal Drive Pin Adapter is available to relieve many of those special difficulties. Check the features below. You'll find that this new Adapter fits neatly and quickly into your take-off process, giving you outstanding money-saving improvements in speed and efficiency. Order today!

Available now with all these features

1. *Drives any spool from 2" to 6" in diameter.*
2. *Holds spool out from spindle to eliminate drag.*
3. *Accommodates any hole location.*
4. *Can be adjusted by finger; no screwdriver necessary.*
5. *Holds screw snug to spacer, eliminating peening.*
6. *Uses present tapped hole; requires no extra drilling or tapping.*
7. *Takes less than a minute to install; saves time in set-up and spool change.*
8. *Has strength and durability; made of metal 1/8" thick.*

ORDER DIRECT

- COSTS ONLY 15c EACH, complete and ready for quick installation.
- ALL YOU NEED TO SPECIFY is size of screw to fit spindle. Three sizes available: 6/32"—8/32"—10/32".

ACROMETAL PRODUCTS, INC.

Manufacturers of the famous **ACROPAK** *spool*

608 North Fifth Street — Minneapolis 1, Minnesota

of the average reflecting galvanometer. Voltage drop for full-scale deflection of the meter is reported to be ½ v for all ranges. The selector switch opens the battery circuits when in the "off" position and also functions as a polarity reversing switch. The instrument is said to be capable of withstanding accidental overloads of 10,000% without damage to the meter movement.

The microammeter can be converted to a high-resistance voltmeter (an input resistance of 100 megohms per v). It can also be used as a high-range ohmmeter. For example, when used with a 45-v battery, the instrument is said to measure resistances as high as 4500 megohms. In this way, it can be used to measure the leakage resistance of insulators, wiring, capacitors, and transformers, and to indicate the dielectric properties of materials such as plastics.

•

MORE NEW PRODUCTS about which you should know

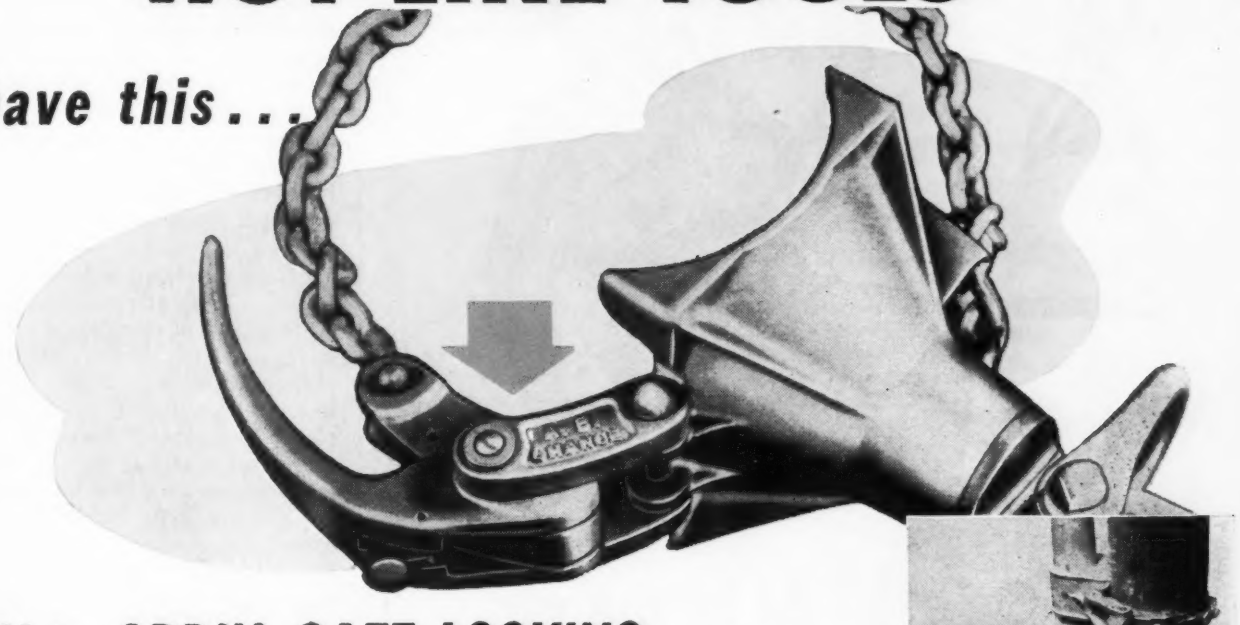
Robertshaw-Fulton Controls Co, Fulton Sylphon Div, Knoxville, Tenn, has a series No. 3000 **packless valve** with a Sylphon bellows for leakproof performance, available in sizes ¼ to 3 in. and for temperatures to 1200 F . . . Rowe Engineering Corp, Chicago 39, Ill. developed a type MW55 **watt-meter** for power measurements 2 to 1,000 milliwatts on 50 to 500 megacycle circuits . . . Hart Manufacturing Co, Hartford, Conn, developed a **temperature switch** with strap-on fitting for control of water heaters; ratings up to 30 amp, 250 v a-c.

McDonald Mfg Co, Los Angeles 11, Calif, produces 3-outlet **receptacles** "Sierra Triplex" rated 15 amp 125 v and 10 amp 250 v, for flush mounting and with brown and ivory matching wall plate.

Jasper Blackburn Products Corp, St.

New CHANCE *Aluminum Fitted* HOT LINE TOOLS

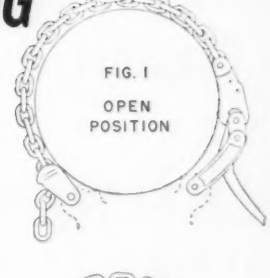
have this . . .



EASY to APPLY, SAFE LOCKING CHAIN TIGHTENER

Now all Chance Hot Line Tools, which are designed for attachment to poles, are equipped with a new light weight chain tightener that can be quickly secured to the pole by a lever operation and is latched with a specially designed safety catch. Except for the small safety latch trigger, connecting bolts, and the chain, the metal parts are made of aluminum alloy and then heat treated to give them added strength. These aluminum parts have been tested and proved to be considerably stronger than the high-strength steel loading chain which has a breaking load in excess of 6000 pounds. The use of aluminum reduces the weight linemen are required to handle on the pole. The lever operation makes application of the chain tightener much easier and faster than the old screw take-up method.

The illustrations at right show the steps of application. First, the chain is wrapped around the pole and engaged in the chain socket while the tightening lever is in open position. (Fig. 1) To tighten, the lever is moved to closed position (Fig. 2) and the safety catch automatically latches. If chain is too loose, the tightener may be released and the chain taken up a link in the chain socket, or a half link adjustment can be made in the take up. (Fig. 3) It is necessary to depress the safety latch and at the same time pull the lever as suggested in the lower photograph in order to release the tightener. Thus, there is no danger of a lineman accidentally loosening the tightener.



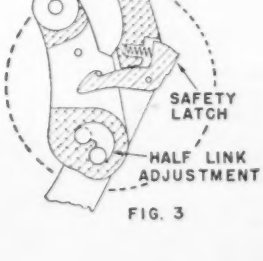
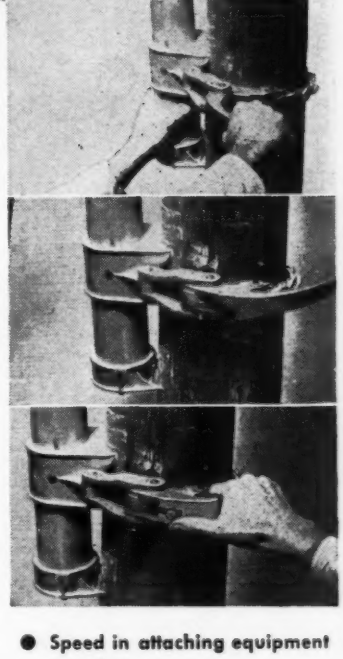


FIG. 3



- **Speed in attaching equipment to poles.**
- **Light weight.**
- **Over toggle latching that holds handle in closed position.**
- **Safety catch to prevent accidental unlatching.**
- **Each unit checked for proper latching before shipment.**
- **Metal Fittings are X-ray inspected.**

C479

A·B·CHANCE CO·

CENTRALIA, MISSOURI • SAN FRANCISCO, CALIFORNIA

ABC INDUSTRIES

Up in the air...

You work with Comfort, Safety & Confidence in a

Buckingham

INDUSTRIAL SAFETY SEAT

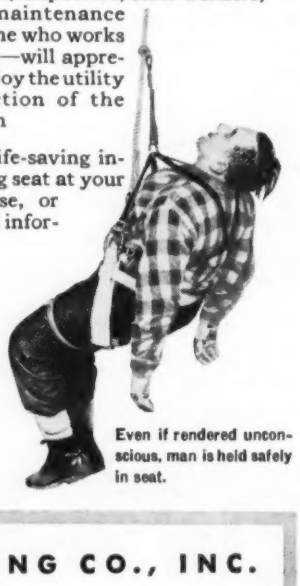
Greater freedom of movement . . . added comfort . . . and sure protection against falling from the seat, whether conscious or not—rigging workers have all these advantages in the BUCKINGHAM Safety Suspension Seat.

The picture shows how the load is carried by the heavy wrought iron hook. The rigid wood seat, which cannot become dislodged while in use, provides more comfortable support for the worker, preventing the binding and constriction encountered in rope or strap slings. Leg straps keep the 5¾" seat always in proper position.

Use of the chest harness makes it impossible for the man to topple from this suspension seat, either from vigorous movement, or from loss of control through sudden illness, accident, sunstroke, gas fumes. The safety cord, fastening to the carrying rope or cable above the worker's head, keeps the user's body approximately in normal position in event of emergency . . . yet does not interfere with customary activity.

Electricians, riggers, steeplejacks, tree surgeons, inspectors, steel-workers, painters, maintenance men—anyone who works from a sling—will appreciate and enjoy the utility and protection of the Buckingham

See this life-saving industrial sling seat at your supply house, or write for full information.



Even if rendered unconscious, man is held safely in seat.

BUCKINGHAM MANFACTURING CO., INC.

Binghamton, N. Y.

Louis 6, Mo, announces a **solderless connector** having a solid rectangular body fitted with a self-contained washer to prevent set screw cutting the wires; three sizes cover a wire range from No. 4 strand to No. 14.

Ohio Electric Mfg Co, Cleveland, Ohio, has developed a **lifting magnet** of welded construction in 39, 55 and 65-in. diam . . . Economy Blue Print Products Co, Chicago, Ill, and Reproduction Products Co, Detroit, Mich, has available a tracing **reproduction machine,** the Direc-Liner, with a Hanovia type printing tube; entire printing and developer sections replaceable as units.

Culco Engineering Co, Los Angeles 25, Calif developed a **battery charger** to deliver 0 to 6 amp and 0 to 58 v, with a pre-set rate of charge said not to vary more than 1% if the input voltage changes as much as 30%. . . . Holdenline Co, Cleveland, Ohio, offers an all-plastic "Arrowhead" **louver** for fluorescent fixtures, said to snap into position on the channel and held by spring clips. . . . Porter-Cable Machine Co, Syracuse, N. Y. announces a Model RS **industrial saw** with radial arm, 1 and 2-hp motors, and 12-in. circular blade to cut full 4 in.

De-Tec-Tronic Laboratories, Inc, Chicago 10, Ill, has produced a **"electric-eye"** kit containing photo tube, chassis, amplifying tube, spdt relay, sockets, and other parts for mounting in a metal case; operates on 115 v, a-c or d-c . . . Western Litograph Co, Los Angeles 54, Calif, has self-adhesive **identification labels** preprinted in numbers, letters and the ASA and NEMA codes . . . Thomson Electric Welder Co, Lynn, Mass, offers an **electronic control** capable of converting 3-phase current into low-frequency, single-phase power for resistance welding.

Cam-Stat Inc, Los Angeles 34, Calif, produces a model CD-111 automatic **temperature control** attached by bolts to electric water heaters; capacity 3,000 w, 120-240 v, a-c, 60 to 190 F . . . Taber Instrument Corp, 144 Goundry St, North Tonawanda, N. Y. designed a **double-edging machine** to bead and fold 500 to 1,000 in. per min of sheet plastic 0.005 to 0.020 in. thick and 2 to 20 in. wide . . . Industrial Models, Arden, Wilmington, Del, builds **scale models** from blueprints for plants; generally uses a scale ¼ in. per ft.

Richardson-Allen Corp, New York, N. Y., is producing portable selenium **battery chargers** rated from 6 to 80 amp for average to fast charging, with 110 v a-c connection, meter and circuit breaker . . . Thomas and Betts Co, Elizabeth, N. J. is producing a combination bronze **pigtail connector** with insulating cap, a 2-piece solderless unit, Cat. PT-66, for use with a maximum of three No. 12 solid or stranded wires.

NEWS ABOUT PEOPLE

Philadelphia Electric Elects Two New Vice-Presidents

Announcement has been made by the Philadelphia Electric Co of the election of K. M. Irwin and H. N. Ramsey as vice-presidents. Mr. Irwin has been named vice-president in charge of engineering and Mr Ramsey in charge of purchases, insurance and real estate.

Following graduation from the Sheffield Scientific School, Yale University, and after serving with the U. S. Navy in World War I, he joined the United Gas Improvement Co as a mechanical engineer. Transferred to the Philadelphia Electric Co in 1931, he was subsequently appointed manager of the company's engineering department, the position he held at the time of his recent promotion.

During World War II he was executive director of the London staff, Public

K. M. IRWIN

Utility Committee, of the Combined Production and Resources Board, and in this capacity made important contributions to the restoration of utility service in northwest Europe.

Mr Irwin is a fellow of the American Society of Mechanical Engineers, and a member of the American Institute of Electricl Engineers, the Association of Edison Illuminating Companies, the Edison Electric Institute, the Pennsylvania Electric Association and the Engineers Club of Philadelphia, of which he is a past-president.

Mr Ramsey entered the utility business as an engineer with the American Gas Co. He later became assistant to

H. N. RAMSEY

the general superintendent of that company and thereafter joined the engineering staff of UGI. He was placed in charge of real estate operations of the United Engineers & Constructors, Inc, in 1931, and three years later became president of the Welsbach Co. He has been purchasing agent of the Philadelphia Electric Co since 1941.

Mr Ramsey is a member of EEI, PEA, AGA and other technical societies.

•

Blinn Resigns as Board Chairman of Ohio Edison

A. C. Blinn will resign as chairman of the board of directors of the Ohio Edison Co, Akron, retiring from all active duties with the company, effective June 30. He will continue as a director.

Mr Blinn has been identified with the Ohio Edison organization and its predecessors since 1916 and has been board chairman since 1944. He went to Akron as vice-president and general manager of the Northern Ohio Traction & Light Co, which then operated the light and power business in that city, the street railway system in Akron, Canton and Massillon and the interurban running from Cleveland to Urichsville. In 1930 he was active in the consolidation of the Akron, Youngstown, Springfield and other utility companies into the Ohio Edison Co, which resulted in the sale of the transportation business. At that time he was made vice-president and general manager. In 1938 he was elected president.

Harold Quinton Elected Executive Vice-President

Directors of the Southern California Edison Co, Los Angeles, have elected Harold Quinton, vice-president since 1942, as executive vice-president. The office had been unfilled since W. C. Mullendore became president of the company in 1945.

Bruce Renwick, formerly assistant

H. QUINTON

general counsel, has been elected general counsel and assistant secretary. He succeeds Gail C. Larkin, general counsel since 1942, and a vice-president since 1945. Mr Larkin, upon his return to the company after a prolonged illness, desired to be relieved of the administrative duties incident to the office of general counsel. He will continue as counsel for the company with the title of senior counsel.

E. R. Davis, vice-president, has retired after completing 52 years of outstanding service to the electrical industry in southern California.

Before his association with the Edison company, Mr Quinton was Los Angeles resident partner of Arthur Anderson & Co, and had been a member of that firm since 1926, going to Los Angeles in 1928 from the Chicago offices. Previous to his association with Arthur Anderson & Co, Mr Quinton for four years had been with the U. S. Treasury Department in Washington, D. C.

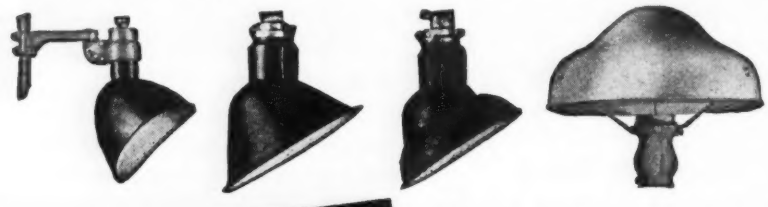
Mr Davis' record of service with the Edison company is the longest of any member of the company. He became

Catalog Bulletins on Sherman Soldering Lugs available upon request.

We put a lot of careful workmanship into the production of all Sherman Soldering Lugs. Dimensions are held to consistent accuracy. Lugs are kept free from burrs, corrosion, etc., and special attention is devoted to maintaining FLAT contact surfaces. All lugs individually inspected before shipment.

H. B. SHERMAN MFG. CO.
Battle Creek, Mich.

Sherman
SOLDERING LUGS



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There are hundreds of applications where the ABolite Reflectors shown above can be used to take full advantage of illumination out of doors. Business well recognizes the value of efficient lighting of signs, buildings, sales and parking areas to gain increased patronage. Extended night lighting of signs and billboards has proven profitable. And don't forget protective lighting is often a necessity.

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distinguished throughout the industry for his prominent part in the Big Creek hydroelectric development in the High Sierra, which was begun in 1911 and has been active in many of the great advances of electrical service in central and southern California. He started his electrical career with the San Bernardino Electric Co in 1896, continued with the San Gabriel Electric Co and when Pacific Light & Power Corp, of which San Gabriel Electric Co was a forerunner, was organized in 1902, he remained in that organization. In 1917 Pacific Light & Power was merged with Southern California Edison and Mr Davis became superintendent of the northern division, with offices in Los Angeles. Subsequent appointments included manager of construction, manager of engineering and construction, assistant general manager and vice-president.

•

W. H. Rowand Appointed Chief Engineer of B & W

W. H. Rowand has been named chief engineer of the Babcock & Wilcox Co, New York. The position is a new one

W. H. ROWAND

created by the recent promotion of Alfred Iddles to the presidency of the company. Mr Rowand will assume most of the engineering activities previously handled by Mr Iddles.

In the course of his 19 years' association with the company he has served in many engineering capacities and has been active in the design and development of boilers.

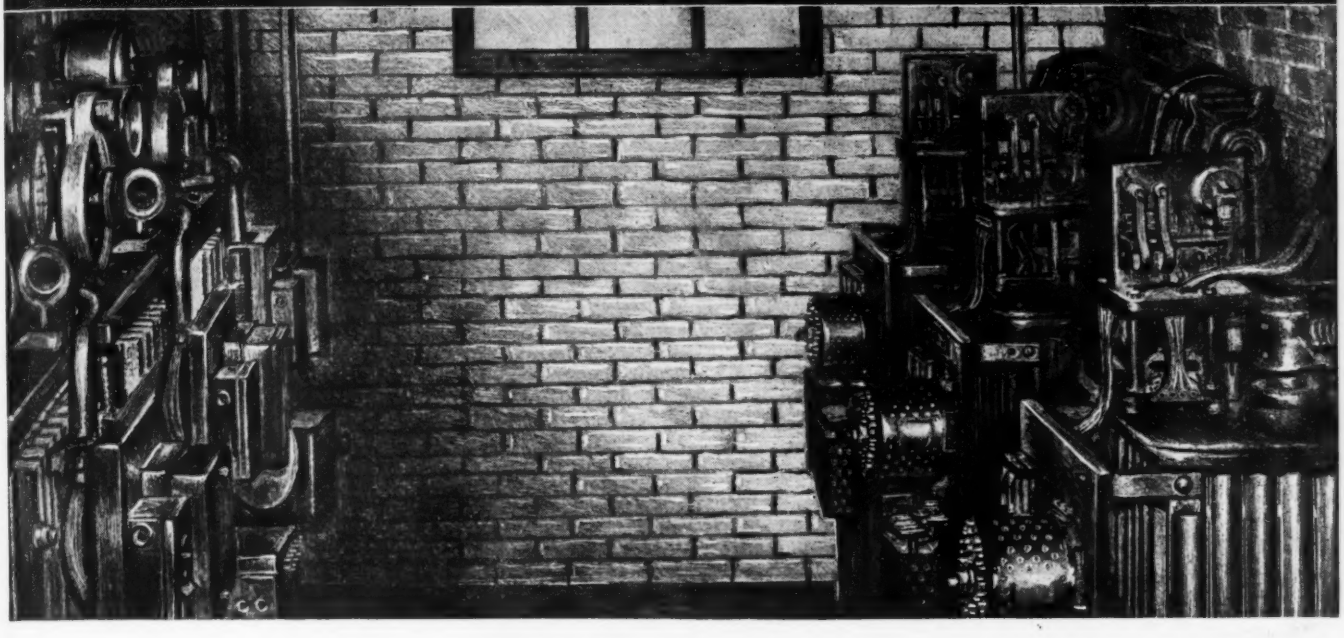
Mr Rowand is the author of a number of technical papers and is prominent in the Metropolitan Section of the American Society of Mechanical Engineers.

•

► P. J. JOHNSON has been appointed supervisor of hydro plants by the Appalachian Electric Power Co, with headquarters in Roanoke, Va. Mr Johnson has been superintendent of Appalachian

WHEN YOU FIRE-PROTECT

REGULATOR ROOMS TRANSFORMER VAULTS



remember: **In more than 500 major power plants throughout the world, regulators, transformers, rectifiers and switchgear depend on *Kidde** carbon dioxide (CO_2) for prompt, non-damaging extinguishing of fire.**

***ALSO SOLD UNDER THE NAME "LUX"**

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MANUFACTURING ENGINEERS

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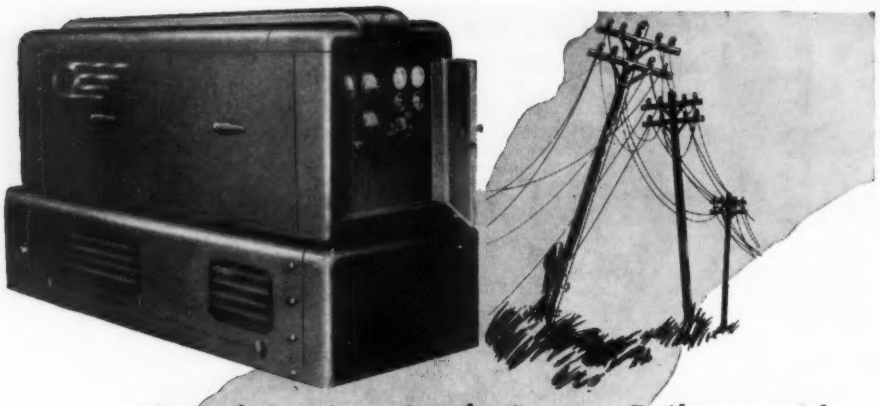

Guard Against Costly Power Failures with

ONAN STANDBY

ELECTRIC PLANTS

When power fails, business comes to a standstill. Materials in process are wasted, men and machines stand idle, lives may be endangered. Prevent the disastrous effects of power failure with a low-cost, easy-to-install Onan Standby System. The generating plant starts automatically when commercial power fails, takes over the power load without interruption, stops automatically when power is restored. Many models: 350 to 35,000 watts, A.C.

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National insulating materials

A COMPLETE SERVICE

Research and field experience by the builders of NATIONAL Coils has resulted in the development of superior insulating materials.

Insulating materials that assure long life and trouble-free service when used in your electrical equipment, are available from NATIONAL.

NATIONAL is the complete source of all your insulation needs.

RAPID delivery from large stocks.

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Varnished Fabrics
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ELECTRICAL ENGINEERS MAKERS OF ELECTRICAL COILS AND INSULATION

DESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

hydro plants in the Kanawha Valley. He succeeds J. B. JUSTIN of Pulaski, who has resigned to become associated with his father as a consulting engineer in Philadelphia.

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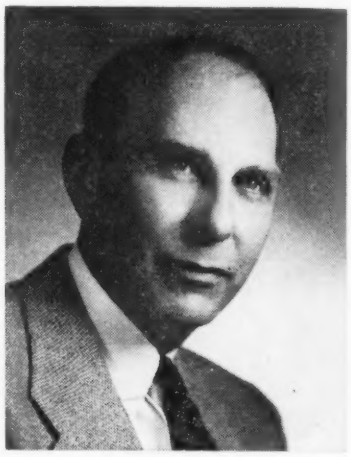
Albertson Electric Elects Schoenecker President

Albertson Electric Co, Milwaukee, Wis., manufacturers of electric power and distribution transformers, has been



H. V. SCHOENECKER

acquired by a Milwaukee group and recently elected a new staff of officers.

Harold V. Schoenecker is the new president and treasurer; vice-presidents are Daniel W. Gellerup, Lee Lerner and Alfred Korbel and assistant secretary, Irving Lore.

Mr Schoenecker began his professional life as an attorney in Milwaukee immediately following graduation from Marquette University. During the war years he served for two years on the executive staff of the National Enameling & Stamping Co, and for three years was assistant to the vice-president of Line Material Co, two years of which were spent at the Zanesville, Ohio, transformer plant.

OBITUARY

► WILLIAM H. ARMSTRONG, for many years superintendent of the Stormont Light & Power Co in the Cornwall (Ont.) district, died on Mar 29 at his home in Toronto. He was 88 years old. Mr Armstrong retired in 1928.

► T. BERGRUN, chief electrician for the Midland Electric Coal Corp, Farmington, Ill., died in Peoria, Ill., on Apr 1. He was 51 years old. Mr Bergrun has been with the Midland company since its founding in 1933. Born in Chicago, he received his technical education at the Bliss School of Electrical Engineers and then became electrical engineer at

DON'T MISS THIS "HIT" SHOW!

"Pittsburgh's" Store Modernization Caravan

WHEN the Pittsburgh Caravan reaches your locality, make sure that you attend one of its "performances."

Here's a unique store modernization and store-lighting show. Two truck-driven 26-foot trailers are utilized in the caravan — each trailer containing six faithfully reproduced scale-models, like the one below — showing the latest advancements in store front and interior designs, as well as in modern store lighting techniques.

Each of the twelve miniature models is lifelike in every detail. A wide variety of businesses are covered, with their individual problems ingeniously resolved.

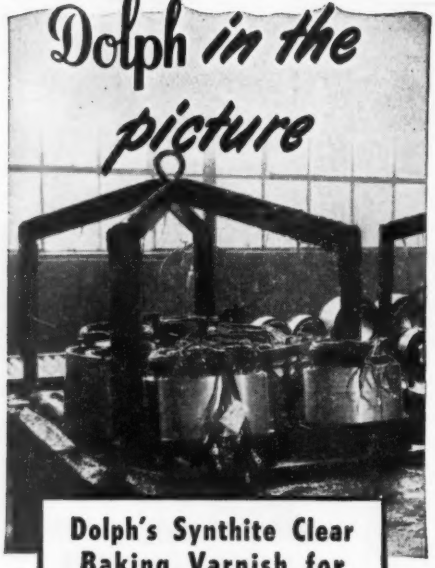
If you are interested in new, more effective ways of building and lighting retail stores, you'll find the Pittsburgh Caravan worth seeing. Since the tour will last many months, advance publicity will inform you when it will reach your vicinity. Watch for it.

"PITTSBURGH"
STORE FRONTS AND INTERIORS

PAINTS · GLASS · CHEMICALS · BRUSHES · PLASTICS

PITTSBURGH PLATE GLASS COMPANY

A Successful Project with Dolph in the picture



Dolph's Synthite Clear Baking Varnish for Deep Curing

Stators Take Baths for Longevity

Crocker-Wheeler Electrical Manufacturing Company, Ampere, New Jersey, needed an insulating varnish that would accomplish this:

Insure long-life to their heavy-duty stators by thorough penetration—and give them a permanent resistance to oil and moisture.

Dolph's Synthite Clear Baking Varnish filled the bill—and provided a plus in exceptionally high dielectric and good heat resistance.

Dolph's Clear Baking Varnish also gives maximum resistance to acids and alkalies—offers dielectric strength over 1800 volts per mil—and can be used on all types of electrical units, large and small.

Call on our Technical Service Department. They'll recommend the *correct* varnish for you. Meantime, write for our catalog. John C. Dolph Co., 1062 Broad Street, Newark, New Jersey.

Member Electrical Insulating Varnish Section, NEMA

Dolph's **INSULATING VARNISH SPECIALISTS**

Marion, Ohio, for the Osgood Co, manufacturers of excavating machinery. Later he engaged in independent power transmission line work, and subsequently in 1927 was appointed electrical engineer for the Marion Power Shovel Co, Marion, Ohio. His connection with Midland Electric Coal Corp followed.

► Dr Edwin W. Hamlin, professor of electrical engineering at Cornell University, died on Apr 27 at his home in Ithaca, N. Y., at the age of 42. Dr Hamlin, who joined the Cornell faculty on Nov 1, was a native of New York and was graduated from Union College, Schenectady. He taught at Union from 1932 to 1935, the University of Kansas from 1935 to 1939 and the University of Texas from 1939 to 1947. At Texas he directed a research laboratory concerned with government contracts for microwave measurement apparatus. He was a member of the American Institute of Electrical Engineers, the Institute of Radio Engineers and the American Society of Engineering Education.

► George H. Rockwood, Jr, professor of electrical engineering, University of Illinois, since 1947, died at his home in Champaign, Ill., following a long illness. Formerly he had served for many years as a member of the technical staff of the Bell Telephone Laboratories, New York. Prof Rockwood was educated at Dartmouth College and at Massachusetts Institute of Technology. He was a member of the American Institute of Electrical Engineers, the Institute of Radio Engineers and the American Physical Society. He had written a number of articles and held numerous patents.

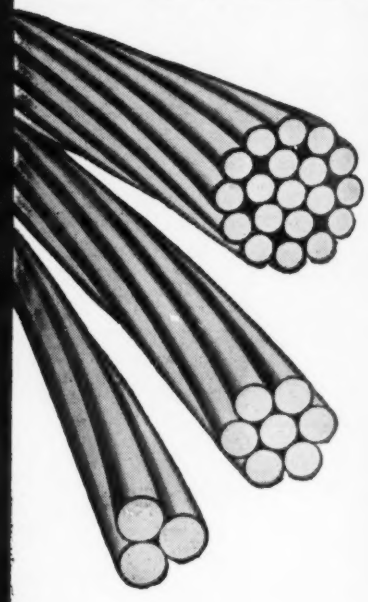
► Wendell J. Wright, general counsel of the Public Service Electric & Gas Co, Newark, N. J., from 1933 until his retirement last November, and a director of that company and the Public Service Corp of New Jersey, died on April 21 at his home in Hackensack, after a long illness. He was 70 years old. Before his appointment as general counsel, Mr Wright had served as assistant general counsel of Public Service Electric & Gas since 1926. Since shortly after his admission to the New Jersey bar in 1901, he had been a member of the law firm of Wakelee, Thornall and Wright, Hackensack, whose senior partner, the late Edmund W. Wakelee, became president of Public Service Corp.

► Clifford Prud'homme, chief electrician for the city of Sacramento, Calif., died there on April 12. He had been a consulting electrical engineer in Sacramento until he entered the city's service 14 years ago. He recently was granted a leave of absence because of ill health.

PAGE

Stainless Steel

STRAND



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in Corrosion Resistance
Tensile Strength
Elastic Limit
Resistance to Vibration
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CONTROLENSES* develop an All-TIME HIGH in Lighting Effectiveness . . at Foley's

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CONTROLENSES Provide 16% MORE LIGHT: 12% WIDER DISTRIBUTION

Excerpt from a recent article in "Illumination"

"The reflectors containing Fluorescent lamps as well as the Incandescent units are equipped with Holophane CONTROLENSES. The decision to employ these lenses was reached after tests which showed that *16 per cent more light* was obtained with lens equipped facilities than with the louvered equipment tested, further, that the effective *distribution was 12 per cent wider* with the lenses than with the louver equipment and that *illumination was more even.*"

The installation at Foley's is one more evidence of the maximum effectiveness of Holophane CONTROLENSES for store lighting . . . To a degree never before reached by built-in lighting, CONTROLENSES afford opportunity for complete freedom in planning. By their extraordinary flexibility, their ability to produce the exact quality and quantity of lighting at any time— CONTROLENSES eliminate the costly "make shift" factor once and for all.

BASIC ADVANTAGES OF CONTROLENSES:

1) The selective line of Holophane CONTROLENSES now embody developments that permit the designer to combine incandescent and fluorescent sources for the most satisfactory color balance or for the effects of emphasis...with literally no break in the integrated design.

2) They provide the means for simple and speedy interchangeability of light-producing and light controlling elements to meet varying retail needs—seasonal, style or merchandising. (Example: complete optics of incandescent elements can be removed and a different type inserted in about ten minutes).

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GOLDEN JUBILEE — Holophane — SINCE 1898 — SCIENTIFIC ILLUMINATION

*Reg. U. S. Pat. Off.

MANUFACTURERS and MARKETS

Mexican Plant Starts Refrigerator Production, Has Practical Monopoly

(McGraw-Hill Wor'd News)

The first Mexican-built electric refrigerators have been completed at the plant of Industria Electrica de Mexico, SA. The plant was opened last month. It is located near Tlalnepantla, 14 miles north and west of Mexico City.

IEM, a joint American-Mexican company, has practically a monopoly in its field. Last year's import restriction decrees caught most U. S. manufacturers by surprise. Only a small handful had assembly or manufacturing plants in Mexico. The restrictions were imposed to protect Mexico's dollar reserves and Mexican industry.

Pres. Miguel Aleman's government has looked with favor on the enterprise. It has received special tax benefits and special import privileges. The company is Mexican controlled but Westinghouse is a stockholder. IEM has a licensing agreement with the American concern under which IEM can manufacture "any or all" products that are made by Westinghouse.

IEM estmates that its five divisions, each manufacturing a different line of products, have a "potential capacity to produce from 30 to 50% of the national demand."

The divisions and their products include:

Division I—Household and commercial products including refrigerators, showcases, electric irons, gas and electric ranges, air conditioning equipment, fluorescent light fixtures, home radios, and other items.

Division II—AC induction motors and synchronous motors up to 500 hp, AC and DC generators, motor generator sets.

Division III—Transformers of various types and sizes, single and 3-phase distribution and power transformers, current and potential transformers, autotransformers.

Division IV—Outdoor and indoor oil circuit breakers, air circuit breakers, disconnecting switches, distribution panel boards.

Division V—Paints, varnishes, enamels, lacquers, and insulating compounds for electrical equipment; soldering materials and babbitt.

Westinghouse contributed the "know how" for the plant. In addition to furnishing the engineering for the plant, it planned production methods. IEM and Westinghouse sent more than 150 men, engineers, draftsmen, overseers, and designers, to the United States for special training courses in Westinghouse plants. The courses lasted from 12 to 24 months.

AMERICAN LEGION AWARD for an effective program of veteran rehabilitation in industry is presented to Copperweld Steel Co, Glassport, Pa. Left to right, William S. Rahauser, district attorney; William J. McIlvane, executive vice-president of Copperweld; Frank Karnash, local Legion commander; and Attorney H. E. Schauffler

Westinghouse Orders Set New Peacetime Record

New orders booked by the Westinghouse Electric Corp during the first three months of 1948 reached a new peacetime high of $242,355,168, President Gwilym A. Price has announced. The previous high for any peacetime quarter was $226,848,611 set in the third quarter of 1947.

Unfilled orders on March 31 were $695,351,456, compared with $685,340,339 at the beginning of the year. On March 31, 1947, unfilled orders totaled $642,090,960.

Mr Price said the company's profit on a sales volume of $209,787,878 for the first quarter of 1948, after providing $1,250,000 for inventory reserve, was $13,135,789, equal to 97 cents a share. This compared with $11,060,195, equal to 81 cents a share, on a sales volume of $140,121,973 in the first quarter of last year.

Profit for the first three months of 1948 was equal to a return of 6.3% on sales, compared with 7.9% in the similar period of 1947. Mr Price said the percentage drop was due largely to increased costs of labor, materials and transportation.

If business continues at the present high level, Mr Price stated, it will be "prudent" to build up the company's inventory reserve to $20,000,000 by the end of this year. At the end of 1947 the inventory reserve was approximately $16,000,000.

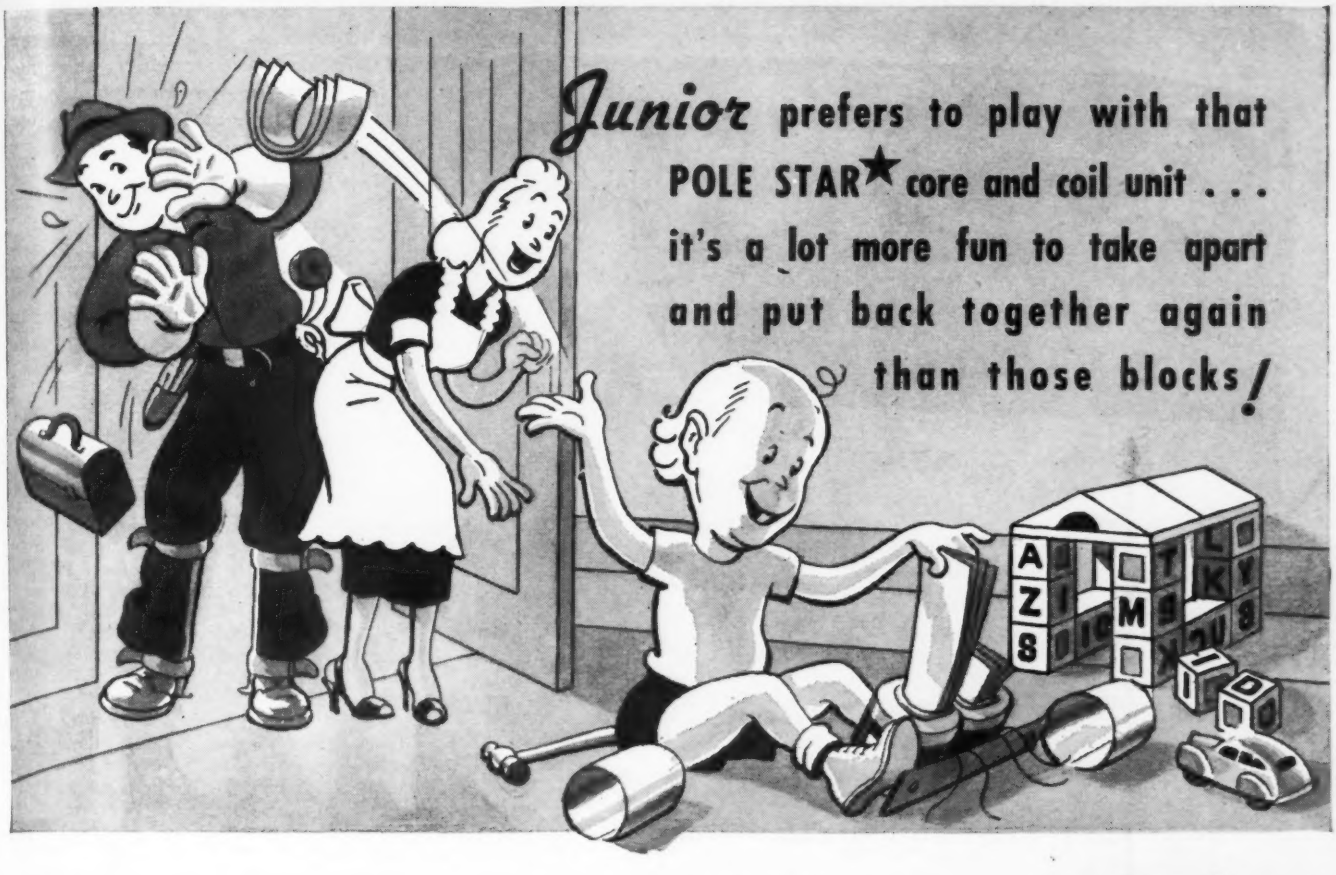
•

Blaw-Knox Backlog Rose $5,000,000 in First Quarter

Unfilled orders of the Blaw-Knox Co rose by nearly $5,000,000 during the first quarter of 1948, William P. Witherow, president, told stockholders at the recent annual meeting. On Mar 31 they totaled $34,475,000, he said.

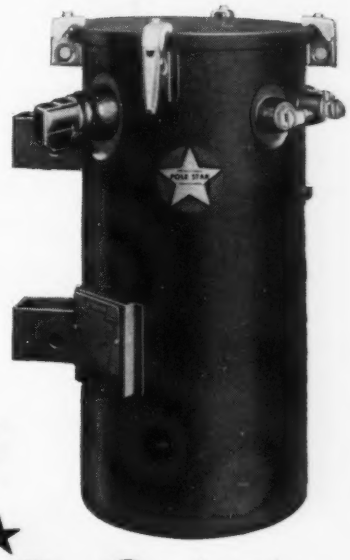
"This backlog," Mr Witherow said, "is not only the largest in the company's peacetime history, but it is well diversified and the current demand for all classes of our products and services is encouraging."

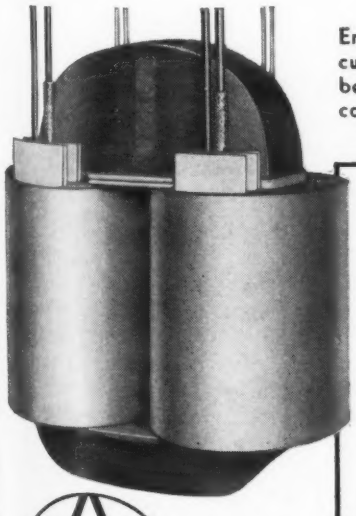
He said first quarter operations had been somewhat impeded due to a critical fuel shortage in plant areas. Steel


Junior prefers to play with that POLE STAR★ core and coil unit . . . it's a lot more fun to take apart and put back together again than those blocks!

YES, the young 'un in the scene above has discovered how simple it is to remove the POLE STAR core from the coils and then reassemble the entire unit. NO, Pennsylvania doesn't expect its coils to go bad, but once in a while a coil is damaged by lightning or by being too heavily overloaded. In many cases it pays to repair or replace a coil rather than scrap an entire core and coil unit.

Pennsylvania POLE STAR core laminations are so arranged, they may be removed from the coils and reassembled without any special tools and without changing the electrical characteristics of the steel. POLE STAR cold rolled, wound cores can be restacked without fear of encountering high core loss or high exciting current. The core is designed and constructed so that the annealed steel cannot be bent beyond its elastic limits.





Embodying a new wound core design with an inherent low exciting current, POLE STAR Transformers are made in sizes of 25 KVA and below, 14400 volts and below, single phase, 60 cycles, OISC, conforming to EEI-NEMA Standards.

LAMINATIONS INDIVIDUALLY LAPPED

Each lamination forms its own flux path. No flux has to cross from one turn to the next. Where the two ends of individual laminations come together, they are overlapped. This 100% additional cross-section at the lap reduces the density and prevents a concentration of flux.

★ ***P.S.*** let the POLE STAR be your guide

Product Of Long Experience

Safe Thrifty And Reliable

POLE STAR TRANSFORMER

Pennsylvania TRANSFORMER COMPANY

PITTSBURGH 12, PENNSYLVANIA

The 7-Range Clip-On Volt-Ammeter

FERRANTI

Offers These Important Advantages

- Measures up to 1000 amps—up to 600 volts.
- Convenient ONE HAND operation trigger action.
- Thumb operated range selector switch.
- 7 ranges—5 current and 2 voltage.
- Insulated core—shockproof construction.
- Takes cables up to 2¼" diameter.
- Distinct calibrations—easy to read.
- Suitable for 50-70 cycles.

RANGES: 0-10 *amps;* 0-25 *amps;* 0-100 *amps;* 0-250 *amps;* 0-1000 *amps;* 0-150 *volts;* 0-600 *volts.*

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Jenkins Bros. also make Diamond Seal Friction and Rubber Tapes which meet ASTM and Federal Specifications.

● You can be sure of a tighter, longer-lasting bond,—a faster, neater job,—because Gold Seal Tape always has plenty of lasting "tack" in the friction compound. What's more . . . Gold Seal doesn't dry out, ravel, or smear the hands. Try Gold Seal. There *is* a difference. Available in single rolls or 10-roll containers. Each roll cellophane wrapped. Jenkins Bros. (Rubber Div.), 80 White St., New York.

JENKINS Gold Seal Tape FRICTION-RUBBER

MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES

supply continues to be a limiting factor in some company activities and this was reflected in operations and earnings for the first quarter, Mr Witherow stated.

•

Manufacturers Make New Sales Assignments

Electrical manufacturing companies have recently made the following appointments to their sales staffs:

Fisher-Pierce Co, Boston, electronic manufacturing and marine specialties, has appointed Barnard & Adams, 50 Church St, New York 7, N. Y., sales representatives to handle their photo-electric street lighting control for the Metropolitan New York City area, north to Poughkeepsie and south to Monmouth County, New Jersey. J. B. Chartrand & Associates, Electrical Equipment Co, 14547 Madison Av, Cleveland, Ohio, has been named representative for the State of Ohio and that part of western Pennsylvania covered by the Pennsylvania Power Co.

Allis-Chalmers Mfg Co has appointed William D. Nesbeitt manager of the Spokane district office. Mr Nesbeitt joined A-C in 1946.

Eureka Williams Corp, Bloomington, Ill., has appointed Frank W. Noble regional sales manager with headquarters in Chicago. His territory will include Illinois, Minnesota, Iowa, Nebraska, North Dakota, South Dakota and Wisconsin. In his former capacity, Mr Noble was in charge of advertising and sales promotion of Eureka products.

Graybar Electric Co, Inc, has opened a warehouse and sales office in Aberdeen, South Dakota. D. G. Hubbard will be manager of the Aberdeen branch.

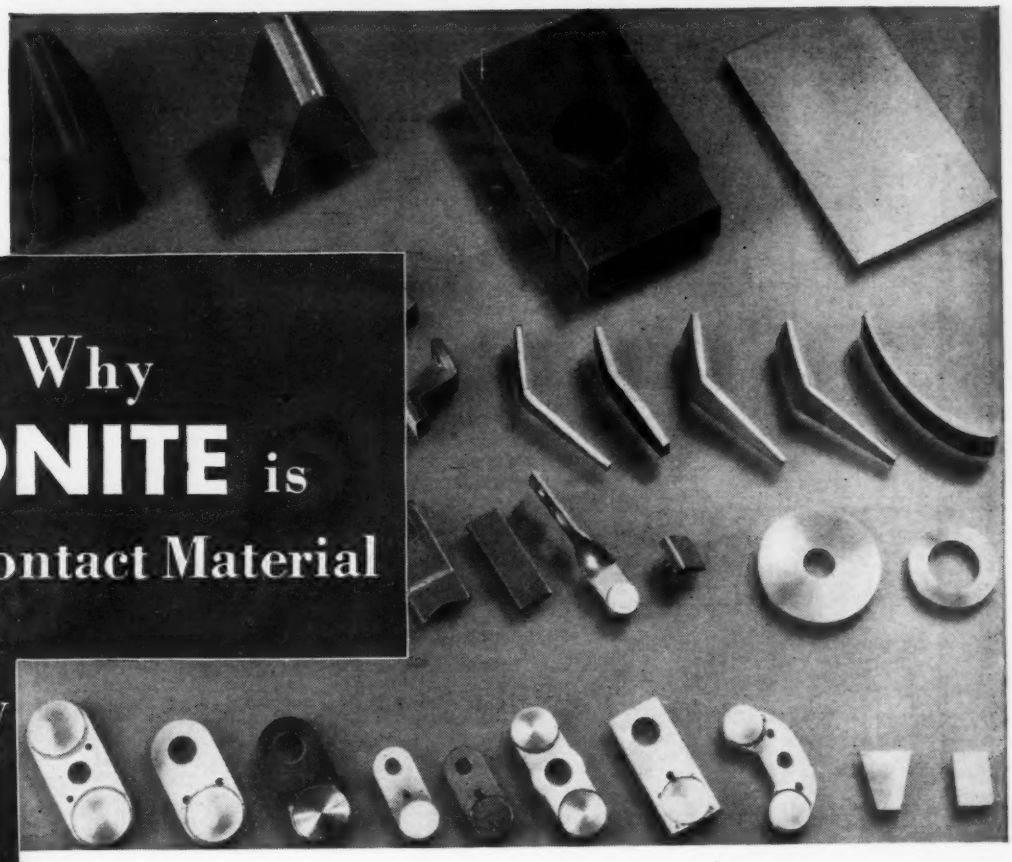
•

Progressive Expands Facilities on West Coast

Expansion of West Coast facilities by the Progressive Welder Co, Detroit, has been announced by A. P. Seedorff, West Coast representative.

Included in the new set-up, which is located at 1161 East Florence Av, Los Angeles, are assembly and service facilities for the company's welding machines. Parts for the company's standard line of air and hydraulically operated C-type, scissors, bell-crank, pinch, push-type and expansion-type welding guns will be carried in stock, as well as numerous standard complete sub-assemblies for gun-welding installations.

Complete service facilities for reconditioning and repair of resistance welding equipment has also been provided. Included in the services of the expanded organization is assistance to West Coast manufacturers in designing their products for faster, lower-cost welding.



Why ELKONITE is Standard Contact Material for Heavy-Duty Circuit Breakers

The combination of refractory metals like tungsten, molybdenum or their carbides with highly conductive metals like silver or copper is a direct result of Mallory's pioneering in powdered metallurgy.

Elkonite* metal is an example. This material combines maximum life with resistance to severe short circuit arcing conditions. That's why it is standard contact material for most heavy-duty circuit interrupting equipment.

Hardness, resistance to mechanical wear and impact, good electrical conductivity, resistance to erosion by arcing, resistance to sticking—these are qualities you can count upon when Elkonite metal works for you. Mallory research has developed Elkonite metal so it can be moulded into almost any shape.

If your application calls for contacts of unusual characteristics, send for the Mallory Contact Catalog. Read the facts on Elkonite metal—then, if you need technical help, our engineers are at your service.

ONLY MALLORY MAKES AND SELLS GENUINE ELKONITE METAL

(Above) The Mallory Catalog of Contacts and Contact Materials—contains all pertinent information on the Mallory line.

(Below) The only volume of its kind in the world, this Mallory Contact Data Book contains everything you want to know about contact design, construction, application and materials. Free to engineers who write on company letterhead. $2.50 to others.

P. R. MALLORY & CO. Inc.

MALLORY ELECTRICAL CONTACTS & CONTACT ASSEMBLIES

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

*Reg. U. S. Pat. Off.

ONLY PIERCE FUSES

have the

RUGGED TUBULAR BRIDGE

- TO MAINTAIN BLADE ALIGNMENT
- TO INCREASE FUSE LIFE

Additional exclusive features that mean better protection and lower ultimate cost are:

1. Balanced Lag Link
2. Screened Ventilation

FREE: Balanced Lag Link to inspect and test. Specify amperage, voltage.

Recent Rate Changes

SAN ANTONIO PUBLIC SERVICE BOARD has announced that residential electric rates will be reduced beginning June 1. The new schedule will reduce the minimum monthly charge from $1 to 50 cents in the city limits. The savings will amount to approximately $220,000 annually for 88,000 customers.

GEORGIA POWER CO has made application to the state Public Service Commission, requesting authority to increase electric rates for residential, commercial and industrial service in the entire territory served by the company. The company requested authority to eliminate the 10% prompt payment discount now contained in its residential, commercial and industrial electric rate schedules which would represent an increase of approximately 11.1% in the net rates under these three classes of schedules. The Cotton Manufacturers' Association of Georgia plans to oppose the increased rate schedule. Walter McDonald chairman of the commission, announced. He said that the commission has postponed its hearing on the proposed increases until May 17. The postponement was requested by President C. C. Hertwig of the Cotton Association. Mr McDonald stated that the association had asked time to prepare an intervention in the case.

GLADES ELECTRICITY COOPERATIVE has been authorized by the Moore Haven (Fla.) City Commission to increase its electric rates. The increase is limited to minimum users, who will pay 25 percent more. The cooperative cited increases in fuel costs as justification for the raise.

LAKELAND (FLA.) LIGHT and WATER DEPT'S recent 10% rate increase on electric service to rural customers has been attacked in a suit filed in circuit court at Bartow. The suit charges that the increase is for the benefit of city residents and is discriminatory when charged to rural residents. Rates to rural customers were boosted 10 percent on Feb 1, when the Lakeland City Commission imposed a 10% utility tax on electric, water gas and telephone service. Because a city cannot impose taxes outside its boundaries, the increase to rural customers was made in the form of higher rates. The suit declares that the city received a net profit of $1,000,000 from electric service in 1947, which should offset the contention that a rate increase was needed to cover increased costs of producing electricity. When they increased the rate and imposed the utility tax, city commissioners said it was needed to meet the higher cost of fuel oil, which would increase by $100,000 a year the expense of operating the electric plant. The rural customers contend they should not be assessed for city street repairs or for the wage hike for city employees.

•

Announces Name Change

The Moorhead-Reitmeyer Co, Inc, Pittsburgh, Pa., has changed its name to the Moorhead Electrical Machinery Co. There is no change in ownership or personnel. William L. Moorhead, who established the business in 1919, will continue as president.

IPCO

SAFETY POUCH FOR SMALL PARTS

Worn attached to the body belt, keeps screws, bolts and other parts in easy reach and speeds up the job.

Sturdy canvas construction with web strap loops through which belt is inserted. Mouth of bag held open by reinforced edge. 8" wide; 9½" deep.

Write for Bulletin B-58

IPCO *Safety Equipment for all Industries*

INDUSTRIAL PRODUCTS COMPANY

2808 N. FOURTH STREET • PHILADELPHIA 33, PA.

Simplex Pole Jacks

PULL OR STRAIGHTEN POLES... *Without Digging*

Compact and husky "H" beam sub-base provides a firm non-slip foundation, even on rough ground or in loose soil. Makes straightening poles, pulling butts or moving loaded poles a fast, easy job for one or two men. No. 329 handles poles of any size. No. 325, used for poles up to 30 ft. in height, includes 8' pike pole that's especially handy for straightening poles located beside ditches. Ask your distributor for full particulars, or write for Bulletin No. U46.

TEMPLETON, KENLY & CO.
1046 South Central Avenue
Chicago 44, Illinois

YOU CAN GO *Up and Up!*

. . . with Square Copper Tube Bus Conductors made by Chase

YES, the square construction of Chase Copper Tube Bus Conductors, provides high mechanical strength in all directions . . . and enables you to install a conductor taller than ever before.

Since Chase Square Copper Tubes have four flat sides, they allow adequate and uniform pressure to be exerted between the large contact surfaces, resulting in *firm, secure joints.* In addition to these advantages—great mechanical strength, ability to make efficient joints and connections—this Chase product is high in electrical and thermal conductivity . . . has high current-carrying capacity . . . is greatly resistant to corrosion.

Write today for informative booklet! Address Chase Brass & Copper Co., Dept. EW58.

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THIS IS THE CHASE NETWORK . . . *handiest way to buy brass*

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SUPERIOR SWITCHBOARD & DEVICES CO.
CANTON 1, OHIO
A subsidiary of the Union Metal Manufacturing Co.

NEW ELECTRICAL CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Alabama—Southern Pine Electric Co-operative, Brewton, 9 mi. rural distr. line, sys. imprvs., incl. 32 mi. new transmission lines, Conecuh Co. **$600,000.**

Georgia — Flint Electric Membership, Corp., Reynolds, 275 mi. rural distr. line sys. imprvs., 25 mi. new transmission line and 13 mi. new tie line, Taylor Co. **$600,000.**

Illinois—Wayne-White Counties Electric Co-operative, J. Wes Barth, pres., 212 Court St., Fairfield, labor only 202.5 mi. rural distr. lines, consisting 98 extens., Wayne, White, Hamilton, Richland and Edwards Counties. Plans deposit $25. Rural Line Engineers, 2 S. Central Ave., Clayton, St. Louis 5, Mo., engrs.

Ind., Gary—Bd. Comrs. Lake Co., Stanley Olszewski, aud., Courthouse, Crown Point, 1 story, brick structural steel, rein-con., heating and power plant for Co. Court House, Jail and Superior Court House. **$112,000.** S. E. Brownsten, Crown Point, co. engr.

Ky., Henderson — Bd. City Comrs., Mayor R. B. Posey, chan., City Hall, 2 diesel engines and generators for municipal power plant, on Ohio River near here. Burns & McDonnell Eng. Co., Banister Rd. and Troost Sts., Kansas City, Mo., consult engrs.

Minnesota—Minnesota Valley Co-operative Light & Power Assn., Montevideo, labor only, 260 mi. rural distr. lines, Chippewa, Lyon, Yellow Medicine, Lac qui Parle and Renville Counties. $75,000. Plans deposit $25. United Eng. Service, 600 Kasota Bldg., Minneapolis, engrs.

Mississippi — Jones County Electric Power Assoc., Laurel, 20 mi. rural distr. lines, sys. imprvs., 10 mi. tie lines, completing previously approved construction, Jones Co. **$330,000.**

Missouri—Black River Electric Co-operative, Ironton, 35 mi. rural distr. lines, completing prevously approved construction, Reynolds Co. **$305,000.**

Mo., Columbia—University of Missouri c/o Curators, Jesse Hall, secy., Columbia, electrical and mechanical addn. to Engineering Laboratories. Plans deposit $25. Jamieson & Spearl, 1696 Arcade Bldg., 812 Olive St., St. Louis, Zone 1, archts.

Nebraska — Franklin County Electric Membership Corp., Franklin, 150 mi. rural distr. lines, Franklin and Kearney Counties, and sub-station, Franklin. **$261,000.** H. H. Nixon Eng. Co., W.O.W. Bldg., Omaha, consult. engr.

Nebraska—York County Rural Public Power Dist., York, completing previously approved construction, York Co. **$175,000.**

Neb., David City—City, power plant alterations, generating unit, pump. equip., switchboard alterations, etc. $175,000. Black & Veatch, 4706 Broadway, Kansas City, Mo., engrs.

Texas—B-K Electric Co-operative, Seymour, 93 mi. rural distr. lines, Baylor Co. **$130,000.**

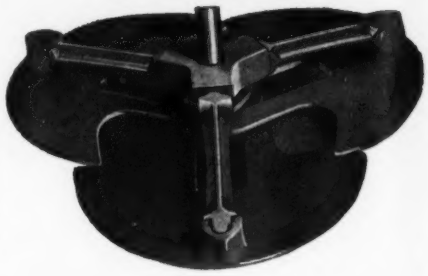
Texas — Brazos Transmission Electric Co-operative, Inc., 902 Amicable Bldg., Waco, 52 mi. sect. 69 kv. transmission lines, Hood, Erath and Comanche Counties; 25 m. pole 69 kv. construction between Granbury and Stephenville; 27 mi. single pole 69 kv. construction No. 2, copperweld conductor—between Stephenville and Comanche; substation at Stephenville and Comanche. $160,000. Joe E. Ward, 418½ Austin Ave., Waco, engr.

Wyoming — Bureau Reclamation, Dpt. Interior, Building 1-A, Denver Federal Center, Denver, Colo., 2.6 mi. 115 kilovolt, 3 phase single-circuit, wood pole, H-frame type Seminoe-Casper transmission line, Kendrick Proj. near Casper, Spec. 2216.

Low Bidders & Contracts Awarded

Ind., Evansville—Southern Indiana Gas & Electric Co., F. B. Culey, exec. vice

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life



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For new construction and maintenance — Everstick Anchors speed up work and provide dependable anchorage on all types of jobs. Made of resiliant, rust resistant malleable iron. The toughest anchors made. Write for bulletin.

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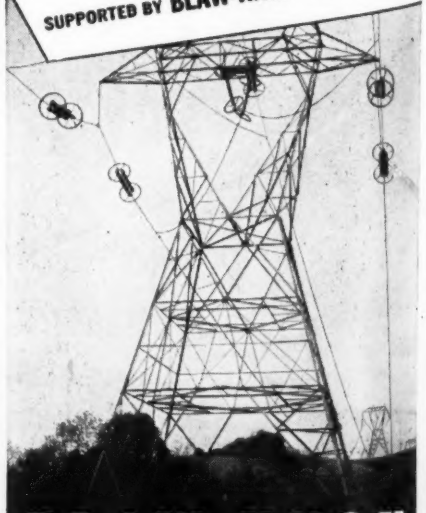
FAIRFIELD, IOWA

OVER HILL, OVER DALE
THE POWER LINES OF AMERICA
SUPPORTED BY BLAW-KNOX TOWERS



BLAW-KNOX
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BLAW-KNOX DIVISION
of Blaw-Knox Company
2013 Farmers Bank Building
Pittsburgh, Pa.

MATTHEWS HOT LINE CLAMP

Vibration Proof

Corrosion Proof

The unique design of the self lubricating lock nut (see description below) in this NEW MATTHEWS HOT LINE CLAMP, prevents the clamp from vibrating loose and eliminates the possibility of the threads on the eye bolt from corroding or "freezing" in the clamp. Positive contact at all times and easy removal of clamp from main line wire, even after years of service, is assured. They can be installed or removed with any standard hook or socket type hot stick. Duck bill of hook facilitates guiding of clamp on main line wire. They are strong, sturdy and long lasting.

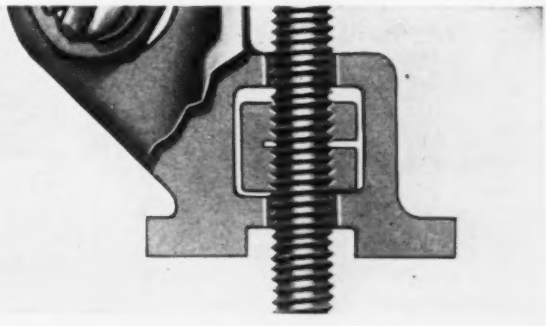
LINE WIRE CAPACITY: Max. 266,800 C. M. ACSR or 300,000 C. M. Copper. Min. 6ACSR or 6 sol. Copper. TAP WIRE CAPACITY: Max. 4 ACSR or 2 sol. Copper. Min. 8 ACSR or 10 sol. Copper.

Available in the following types:

- All Purpose Clamp (cast bronze, plated) for connection of wires of like or unlike metals.
- Cast Aluminum Clamp for aluminum to aluminum or aluminum to copper connections.
- Cast Bronze Clamp for connections of copper to copper.

Write For Bulletin 206

Shows detail of lock nut made of "Oilite Bronze." This patented metal permanently impregnated with oil at time of manufacture provides lubrication for threads of eye bolt. When eye bolt is tightened, pressure is applied to bottom of lock nut which slightly deforms due to the split design, thereby locking threads tightly. When eye bolt is unscrewed, lock nut returns to original shape and releases threads.



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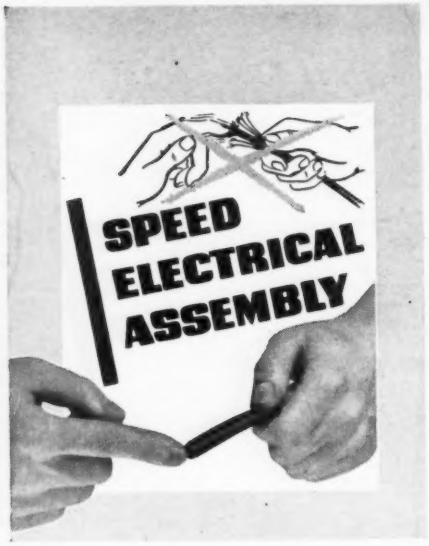

with non-fraying

DIEFLEX

VARNISHED TUBING PRODUCTS

YOU can eliminate many headaches and assembly problems if you specify a varnished tubing that does not fray during assembly operations. Fraying not only slows production, but is a source of electrical trouble. Dieflex varnished tubing products are noted for their ability to be cut evenly and cleanly, to return to roundness after cutting, and to withstand handling and the rough usage of product assembly without back-raveling or fraying. They save you assembly time and cut your costs because you won't need to do the same job twice.

Dieflex varnished tubings and saturated sleevings of finely braided cotton or inorganic glass fiber have this non-fraying characteristic in all grades and sizes. In addition, all Dieflex products have extreme flexibility, high dielectric strength, smooth inside bore, excellent push-back quality, and many other superior features. You can't go wrong when you specify Dieflex on every job.

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MANUFACTURERS CORPORATION

ELECTRICAL INSULATION

★ CHICAGO 6, 565 West Washington Blvd.
★ CLEVELAND 14, 1231 Superior Ave., N. E.
MILWAUKEE 2, 312 East Wisconsin Ave.
DAYTON 2, 1315 Mutual Home Building
DETROIT 2, 11341 Woodward Ave.

REPRESENTATIVES in MINNEAPOLIS 3, 1208 Harmon Pl., and PEORIA 5, 101 Heinz Court

pres., Hullman Bldg., 1 story, brick, rein.-con. structural steel 40,000 kw. capacity power plant and pump station addn., to Ryan Constr. Co., 402 Court Bldg. **$601,-845.** Awarded 4/19.

Mich., Traverse City—State, State Office Bldg., Lansing, Apr. 15, general contract power house at Traverse City State Hospital, from The Christman Co., 408 Kalamazoo Plaza, Lansing, **$552,481;** mechanical work, from C. L. Mahoney, Kalamazoo, **$408,000.**

Minn., Minneapolis—B. F. Nelson Mfg. Co., 401 N.E. Main St., general contract 2 story, bsmnt., 50x80 ft., steel frame turbine room addn., to Johnson, Drake & Piper, 1138 Baker Bldg. Est. approx. **$230,000.**

Pa., Williampsort — The Reading Co., Reading Terminal, Phila., diesel shop facilities addns., imprvs., to Lundy Constr. Co., 1896 W. 4 St. Over **$100,000.**

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Ala., Mobile—City, police station, jail, kitchen and laundry equipment. $1,000,-000.

Calif., Albany—Pacific Gas & Electric Co., 245 Market St., San Francisco, steel natural gas storage tank. **$4,000,000.**

Calif., San Francisco—Metropolitan Life Insurance Co., 600 Stockton St., eleven 13 story, rein.-con. apartments, Lake Merced Area, incl. shopping center, tennis courts, playing fields, etc. **$30,000,000.**

Calif., San Mateo—David D. Bohannon, 859 San Mateo Dr., plans by E. Wadsworth, 515 Almer Rd., Burlingame, 2 story, frame, stucco apartments, Hillsdale subdivision. About **$6,000,000.**

Del., Wilmington — E. I. duPont de Nemours & Co., Inc., Dupont Bldg., Wilmington, Zone 98, plans 10 laboratory and semi-works buildings for research. Total cost **$30,000,000.**

Ind., Indianapolis—American Foundry Co., Blaine Miller, pres., 1535 Naomi St., 1 story, 190,000 sq. ft. mfg. plant, Tibbs Ave. and Morris St. **$3,000,000.**

Ind., Westville—State Div. Procurement & Supply Div., O. F. Heslar, dir., 404 State House, 5 story state hopsital. $1,-200,000. Plans deposit $50. Boyd E. Phelps, 232 Franklin St., Michigan City, engr. and archt.

Mo., St. Louis—Falstaff Brewing Corp., 3684 Forest Park Blvd., Zone 10, brewing and bottling plant. Approx. **$1,000,000.**

Pa., Drexel Hill—Peter S. Mezino, 400 Shadeland Ave., shopping center, incl. theater, 50 stores, supermarket, parking lot, State Rd. and Township line, separate contracts. **$5,000,000.** Damon & Foster, Sharon Hill, engrs.

Tex., Brazoria—Phillips Petroleum Co., Bartlesville, gas line extraction plant. $5,000,000. Tentative price.

Tex., Daingerfield — Lone Star Steel Corp., Daingerfield, and Cotton Exchange Bldg., Dallas, steel pipe mfg. plant, **$7,-000,000;** expansion iron ore production plant, **$2,000,000.**

Tex., Port Arthur—Wilson Bros., 222 W. North Bank St., Chicago, Ill., and c/o Bov Blanton, Port Arthur 3 to 4 story, bsmnt., masonry department store. **$1,-000,000.**

Low Bidders & Contracts Awarded

La., New Orleans—South Lake Realty Co., c/o contractor, hotel, to Milton Constr. Co., 148 S. Western St., Chicago, Ill. Est. **$2,500,000.**

N. Y., Port Chester—Life Savers Corp. N. Main St., general contract mfg. plant addn., to White Constr. Co., 95 Madison Ave., New York, **$950,000;** electrical work, to Whiffen Electric Co., 84 Martine Ave., White Plains, **$78,000.** Bids 4/2.

Pa., Pittsburgh—National Biscuit Co., 6425 Penn Ave., 3 story, approx. 100x375 ft., steel bakery addn., modernization. Penn Ave., to Turner Constr. Co., 42 Lexington Ave., New York, N. Y. Est. **$4,800,000.**

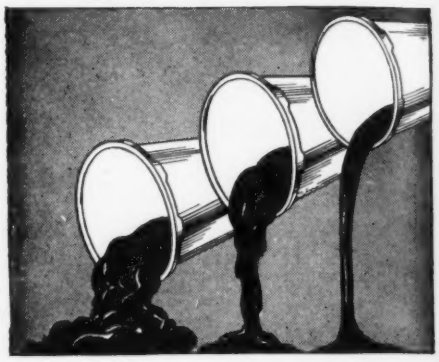
Va., Norfolk—Oceanair Apartments, c/o W. Taylor Johnson, Dean Bldg., apartment development, 71 bldgs., to Byrne Organization, 2607 Connecticut Ave., N.W., Wash., D. C. **$2,500,000.** T. David Fitzgibbon, Royster Bldg.

Wash., Tacoma — Pacific Telephone & Telegraph Co., 757 Fawcett Ave., 4 story, 37 x 123 ft., brick, rein.-con. telephone bldg. addn. to MacDonald Building Co., 1517 South Tacoma Way. **$838,000.**

Insulating and Cable-Pulling

COMPOUNDS

of Record-Breaking Performance



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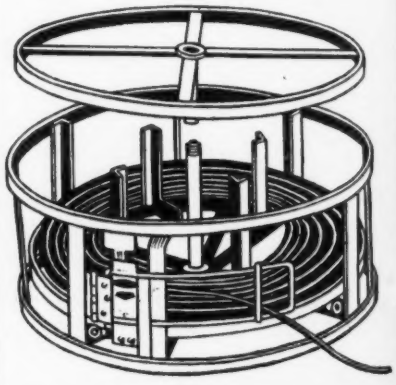

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Here is an all metal, non-wobble, self-attended WIRE REEL, with automatic brake operated by outgoing wire, accurately adjustable safety pay-out, and take-up.

SENT TO YOU ON 10-DAY FREE TRIAL OFFER!

Adjustable from 10 to 34 in.

Whitaker also makes small reels for inside wiremen's use.

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